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TECHNICAL EDUCATION.

APPRENTICESHIP SCHOOLS IN FRANCE.

SILVANUS P. THOMPSON.

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BY

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Fellow of the Royal Astronomical Society;
Member of the Physical Societies of London and Paris;
Professor of Experimental Physics in University College, Bristol;
Author of "Technical Education; where should it be given?" "Suggested Scheme for a Central Institution for Technical Education," &c., &c.

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APPRENTICESHIP SCHOOLS IN FRANCE.

INTRODUCTORY.

TWELVE years ago, at the time of the then existing Exposition Universelle of 1867 at Paris, a letter* was addressed by one of the most distinguished of British jurors to the Chairman of the Schools Inquiry Commission then sitting, in which the following questions were virtually raised:

Firstly. Is England really losing her advanced position in those industries which involve the application of scientific knowledge to production?

Secondly. Is this retrogression due to her comparative backwardness in the diffusion of applied science?

Her Majesty's Commissioners without delay sought the opinion of the most distinguished of English men of science and of the British jurors at that Exhibition. With some slight differences of expression in their opinion they one and all affirmed the conviction that the lack of Technical Education on the part of British masters and British workmen was surely sapping the position of Great Britain as mistress of the arts of peace and of war.

It would not be fair to credit to a lack of Technical Education all the present unhappy depression in trade. Many other causes, inequalities of tariff, inequalities in the price of labour, inequalities in productive power of foreign countries as well as of our own, are and have been at work. Concerning the first

* Vide Report relative to Technical Education. Schools Inquiry Commission, 1867. Letter of Dr. Lyon Playfair to Lord Taunton.

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of these causes we have heard much of late; and if the wealth of a nation, or such fluctuations of its wealth as commercial crises indicate, depended merely upon the price of raw materials or of wages, then an argument founded upon inequality of tariffs would possess more weight than can at the present moment be conceded. But, as it happens, those of our national industries which have felt most severely the depression in trade are, for the most part, those in which skilled labour tells for a great deal; the iron and steel industries; the industries in cloth, in weaving, dyeing, and spinning; the industries in silk, in ribbons, in tools, in watches:—we need not further particularize. The lack of Technical Education is costing us dearly—has cost us terribly dear,—in spite of the oft repeated warnings of those who saw the efforts which continental nations were making to surpass us, as they could only hope to surpass a nation possessing vast natural advantages, by organising the technical education of their artizans, and by giving to the sons of the wealthier commercial classes and employers of labour that sound scientific training which alone could qualify them to use to the highest advantage the technical training given to the artizans. Scientific and technical education go hand in hand. Neither is competent alone to bring about that development of the skilled industries which together they can effect. At the first sight it might be supposed that, provided the younger generation of employers of labour possessed a scientific training, the application of their science to the better technical training of the artizan would follow as a matter of course. Those who argue thus leave out of sight one most important link in the chain of cause and effect, viz., that in consequence of slow and almost insensible changes, wrought by social agencies during the last three generations, apprenticeship no longer exists except in name. All that was best and most valuable in the old system of apprenticeship as we inherited it from our forefathers of the middle ages, has vanished, leaving behind it as the inheritor of its name and of its legal prestige a system

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in which only its worst and least advantageous features are retained. The life of the apprentice in the bosom of his master's family, the pride of the master in his craft, the secrets of trade perpetuated only by being handed down within the narrow circle of the craftsmen of the guild,—all these vanished from the moment when the capitalist replaced the master-craftsman as the employer of apprentice labour, leaving behind little more than the petty tyrannies and the subservience to obsolete rules of thumb which degrade so many workshops even of the present day. In an article which appeared in 1876 in the Contemporary Review, Mr. George Howell has drawn a graphic picture of the decay of the apprenticeship system*: but

* "In the olden times the employer was also a workman; he had himself learned his craft and understood it so as to be able to teach it to another. The question therefore as to taking apprentices rested with himself and with the parents or guardians of the intended apprentices. Usually they were received into the family, they were fed and clothed, and slept in the houses of their masters, being in fact domestic apprentices, at a time when many of the industries of the country were chiefly domestic trades instead of being carried on by great firms and in such large establishments as we see now." "But a change was coming o'er the spirit of the dream; another day was dawning, fraught with still greater issues to the journeymen, for, instead of the old system of mastership and craftsman, there grew up quite another kind of mastership and of hiring. The master had already begun to be less the craftsman and more of the employer. Capital was fast becoming the great motive power. Streams were first utilized, then steam; complicated machinery was being substituted for hand labour in many of the growing industries of the time; the master no longer worked at the trade himself—he directed and found the capital. The number of persons employed was also greatly augmented; instead of the old fealty between master and men there came estrangement more and more, until sometimes the workpeople scarcely ever saw their veritable employer. Under these circumstances the conditions of apprenticeship were completely changed, not suddenly, but gradually, until the apprentice became merely the boy-worker, with less wages but more solemn engagements than a journeyman. The master to whom he was bound no longer taught him his trade; he was so to speak, pitchforked into the workshop to pick up his trade as best he could, or to learn it from the many journeymen who were there employed. It was no one's duty to teach him; there was no pay and no responsibility." "And it must be remembered that it formed no part of the journeyman's contract of hiring or of service to teach the master's apprentices; it was his duty to work, not to instruct, to perform his own labour, and not to give his own experience and the mysteries

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he has done more: he has given a careful analysis of the existing conditions of apprentice labour for all the most important industries of the country, reviewing those conditions chiefly from the point of view of the rules of the trades' unions and of the technical training of apprentices. Any person who is disposed to dispute the nature of the connexion between the depression of trade in the skilled industries and the question of technical education, has only to refer to Mr. Howell's masterly article to realise how intimate in its nature that connexion is, and to learn how utterly hopeless it is, on the one hand, to expect that the system of apprenticeship we have inherited from the past can afford a technical training to the skilled artizan, and, on the other, how utterly futile must be any attempt to galvanize that system into life.

The pioneer of a new reform, whether that reform be economic, educational, or social in character, labours in general under a disadvantage. To most of those to whom he addresses himself his projects are wholly unreal, ideals incapable of translation into practice. He is too *doctrinaire*. The very suspicion of this is often fatal; for his ideals, even when in truth practicable, may remain ideals because he does not succeed in convincing his audience that they can be translated into practice. What must he do then? He cannot in general even adduce the results of an experimental test of his theory. He cannot rivet his hearers with an array of new facts or new successes ready won. He therefore falls back upon the resource of abusing the errors and weaknesses of the existing state of things in order to convince others that they have some grounds for being asked to listen to a new theory.

The explorer in physical science has here a double advantage over the pioneer in economics; for, while he still may utter

of his craft to a stranger for no recompense or reward, unless, indeed, it was the prospective reward of being shouldered out of the workshop by the very boy to whom he had imparted all his knowledge and skill." George Howell, in the *Contemporary Review*, October 1877.

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a preliminary grumble over inadequate hypotheses or exploded modes of thought, he can, in general, put his theory to the test of experiment; and having experimented he can definitely adduce his results in support of the theory he propounds. New facts, especially if won upon the basis of deductive thought always command attention; and discussion on the merits of fact is always more fruitful, though perhaps not always so brilliant or exciting, as discussion on hypothesis or imagination.

Happy is the social reformer who finds himself in the rare case of being able to adduce in the manner of the explorer in physical science the results of observation and experiment. Having already indulged in a preliminary grumble over the existing state of things, it is our pleasant task to recount the results actually attained in certain experiments recently made in France in the direction of organising a New Apprenticeship more in harmony with the social conditions of the age. These results are adduced in the view of showing:

Firstly. That the systematic instruction of apprentices is possible.

Secondly. That it can be effected in several different ways.

Thirdly. That Apprenticeship Schools afford a most satisfactory and economically sound way of attaining this result.

Fourthly. That this New Apprenticeship solves the knotty problem of technical education which arose from the decay of the old Apprenticeship.

It may perhaps be well to state at the outset that in this treatment of the subject it will be regarded chiefly with respect to its economic and social bearings: though some consideration of its educational aspects will not be out of place.

The difficulty that besets the training of apprentices in England is that they enter the workshop either too early or too late. Those who enter early are badly instructed in elementary knowledge to begin with. Perhaps they can neither read nor

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write with facility. They certainly are deficient in a knowledge of common things, even of the simplest scientific facts. Their intelligence is as yet undeveloped, and when they are set to work they learn to go through their task as a mechanical effort. Their employer who is probably a non-working capitalist does not teach them the rudiments, much less the technical and scientific principles, of their trade. The foreman has no time to teach them, even if he had the capacity; being foreman not so much on account of superior skill as because he makes a good task-master. The hands employed have their own work to execute. There is none to train the apprentice. He is the common drudge, set to execute all kinds of miscellaneous jobs. There being no systematic gradation in the difficulty of the exercises given him, more than half his hours are purely wasted, and the other half spent largely on work unsuited to his capacity. What wonder that an apprenticeship of even four, or five, or six years fails to make of him anything but a bad, unintelligent, unskilful machine, ready to hang on to the skirts of a Union that will at least promise him that he shall be no worse off than the mass of his fellows?

Those who enter the workshop too late, are the lads who have stayed long in the elementary school: so long that in many cases they have lost the taste for manual labour. From the age of seven to that of fourteen they have had no other occupation than to sit at a desk, pen in hand, pursuing a course of study founded on purely literary lines. They have no fancy to don the corduroy of the workman, or to make their brows sweat in earning their bread. They want to be clerks or agents or perhaps pupil-teachers. They have passed what is for many of them the critical age at which the aptitude for a manual career is acquired: for the training of hand and eye must, for many skilled industries, begin very early to develop if full perfection is to be attained. A most intelligent employer of labour in a Midland town, with whom the writer is acquainted, had occasion recently to advertise on the same day for a

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skilled workman for a situation where he might earn £4 per week, and for a clerk at £80 a year: and for the latter post he had sixty times as many applicants as for the former! Not without some reason have we of late heard complaints against the education given under the School Boards. Yet it is not that too much education is given to the children: it is that the education given is of the wrong sort. It is true that good education aims at developing capacities rather than at merely imparting knowledge. But capacities for what? Surely not for literary study—that is not what our budding artizans require —but a capacity for turning to the very best account every faculty of body and mind, especially the faculty of those otherwise mischievous organs, eyes and hands. Rousseau once remarked that to know how to use one's fingers gave a superiority in every condition of life. Even if our elementary schools could not attain to this, their failure might be excusable if they succeeded in imparting a knowledge of useful facts such as the simple elements of the natural sciences or of machinery. Are those schools fitted for artizan children which impart neither useful knowledge nor the practical capacity so essential in after life? Surely there is much need to reform the antiquated programme of our Educational Department.

The problem that the old apprenticeship has failed to solve, and which a new apprenticeship must solve, is this: how to give to artizan children that technical training and scientific knowledge which their occupation demands, without detaining them so long at their schooling as to give them a distaste for manual labour.

Four different solutions of this problem are possible: and all four have as a matter of fact been tried. They are given seriatim as follows:

First Solution.

Send the children to work in the factory or workshop at an earlier age, making it obligatory all through their apprentice-

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ship that they shall have every day a certain number of hours schooling in a *school in the workshop* or attached to it.

SECOND SOLUTION.

Keep the children at school as long as their education is unfinished, but set up a *workshop in the school* where they shall pass a certain amount of time every day so as to gain at least an aptitude for manual labour.

THIRD SOLUTION.

Organize *a school and a workshop side by side*, and co-ordinate the hours given to study with an equal number of hours devoted to systematic manual labour.

FOURTH SOLUTION.

Send the children half the day to the existing schools and the other half to work *half-time* in the workshop or factory.

For the sake of brevity we will refer to each of these systems by the phrases which are italicised in each case. Before we proceed to discuss them in closer detail, let us return to the remark that they have all been tried. They are in fact, all in operation at the present time, though not in England. Some of them have been tried in Germany, some in Switzerland, some even in Russia, and all of them in France. There are schools of all these types in active existence at the present time in Paris. We will therefore draw most of our illustrations from the source where they are most available; and indeed in this respect we are fortunate in finding so many different types collected within so small an area. For we might roam Europe over and not discover Apprenticeship Schools so diverse in type, yet so typical in their diversity, as are the Apprenticeship Schools in Paris.

THE SCHOOL IN THE WORKSHOP.

Apprenticeship Schools of the first type, "*The School in the Workshop*" have existed in France for nearly thirty years. One of the oldest of these is in the famous factory of opera-glasses

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of M. Lemaire of the Rue Oberkampf, Paris. The thirty apprentices of this establishment throughout their four years' term of service have two hours schooling every day in a properly fitted schoolroom in the establishment. As another excellent example may be cited the typographical school for the apprentices of MM. Chaix and Co., the printers of the well known "Indicateur" railway time-tables, in Paris. The school has been in existence seventeen years: it has supplied nearly a hundred able workmen to the firm, and the few who have gone out to find work elsewhere hold good situations. The pupils who enter the establishment are bound as apprentices for four years, the formal contract including a guarantee on the part of the employers to find a place for the apprentice when his time is out. They are grouped in two sets, the compositors and the printers. The apprentice printers work at the machines under the superintendence of competent foremen; the apprentice compositors are employed in a composing room separate from, but overlooking, the great *atélier* of the establishment, whence they look down on the busy work of the shop, the machinery, the presses. At the other end of the long room stands a bust of the late M. Napoléon Chaix, the founder of the house, and overhead the golden words "La Maison pour chacun; tous pour la Maison" glitter along a cross beam of the ceiling. Hard by is a neat schoolroom capable of seating the thirty or forty apprentices and in which they spend two hours every day in regular lessons. There are three courses of study; an elementary course for those whose previous education is incomplete; a technical course on typography, including grammar, writing, and composition, the reading and correction of proofs, the study of different founts of type, engraving on wood and steel. This course also includes the reading and 'composition' of Latin and Greek, without any attempt to teach grammar or translation of those languages, and of German and English in which grammatical lessons and exercises for translation are also given. Lastly there is a

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supplementary course on some outlying subjects, the history of printing, mechanics and physics, elementary lessons on economics, and a few notions of applied chemistry dealing chiefly with such matters as soda, carbon, turpentine, oils and acids. Each apprentice every time he enters the schoolroom receives, if punctual, a penny (ten centimes). From the time they enter, the compositor apprentices receive also a small wage which rises during their apprenticeship from the fivepence (50 c.) a day, with which they begin, to two shillings (2 fr. 50 c.) a day. The apprentice printers receive, similarly, from sevenpence half-penny (75 c.) to three and eightpence (4 fr. 50 c.) a day. At the end of their apprenticeship most of the pupils remain by preference as employés, and will earn from three to six shillings a day during their first year as workmen. They also become participants in the bonuses annually divided between the "attached" workpeople of the house, that is to say those who either by apprenticeship or by long service become entitled to participation. No fewer than 258 out of the 700 hands employed are participants, and of these nearly a hundred are past apprentices. There is also an excellent system of savings' bank deposit, of life insurance, and of insurance against sickness and accidents, organised in connexion with this house. The sacrifices made by the principals of the establishment in various ways for the benefit of their hands are very large. Thus every year M. Chaix places a sum of 15 francs to the credit of every apprentice who has savings in the *Caisse d'Epargne;* besides a liberal interest reckoned on the actual amount. The total sum distributed to the employés in 1878 exceeded £2000. Special pains are taken to systematize the practical teaching. Firstly, the compositor apprentices in their separate room and under the direction of a *contre-maître* are set to work on chosen exercises suitable to their age and capacity, and "such as to introduce successively to their notice all the various difficulties which they must surmount in order to understand their business and to become first-rate workmen." Thus during the first year

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they are taught the generalities of typography, the different founts and faces of types, and the systems of spacing and setting lines. During the second and third years they have to set up titles, tables, and learn correcting proofs. In the fourth year they are put under the charge of the workmen who put the type into pages, and work in the principal shop. The system of training, directed by M. Berger, appears to be eminently satisfactory; the pupils make good progress, and work steadily and fast. Their proximity to the main workshop keeps them *au courant* with the exigencies of business, and the habits of thrift inculcated and acquired remain in after life. The statistics of the expense of founding and maintaining the school have never been published. But the rapid growth and prosperity of the firm, and the excellence of its productions are undeniable. How far this success is to be attributed to the good influences of the school, or what measure of it must be accredited to the other agencies, the division of bonuses, the encouragement to insurance and to the laying by of weekly savings, cannot be confidently told. The principals of the house attribute their prosperity as much to one cause as to the other.

The success of these and other schools of a kindred nature has been such that of late many such schools have been organized in France. Before the end of 1877 there existed 155 factories in different parts of France in which similar schools had been established: at the close of 1878 there were no fewer than 237 schools of this character. As very little collective information has been published concerning these schools, and as it is easy for travellers in France to obtain permission to visit them, the following list of some of the most important and successful of them is appended.

1. MM. Chaix et Cie. 26 Rue Bergère, Paris. (Printers.) 30 apprentices; compositors, printers, lithographers.

2. M. Lemaire. 22 Rue Oberkampf, Paris. (Manufacturer of Opera-glasses.) 30 apprentices, (boarders,) and 255 workmen, 200 of whom have been apprentices. Established 1850.

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3. M. Alexandre Hémon. 134 Rue du Temple, Paris. Manufacturer of jewelry and plated jewelry. 30 apprentices, (boarders.)

4. M. Julien Hayem. Boulevard Voltaire, and 28 Rue du Sentier, Paris. Shirt maker, etc. M. Hayem is author of an excellent article on the organization of factory schools.

5. M. Soufflot. 10 Rue Quatre Septembre, Paris. Jeweller, etc. A capital little school of art for the apprentices of the establishment.

6. M. Savard. Rue Saint Gilles, Paris. Jeweller and manufacturer of plated jewelry. Good school of art for 25 apprentices.

7. M. Piat. 85 Rue Saint Maur, Paris. Engineer-founder. Evening school for apprentices.

8. MM. Alfred Mame et fils. Tours. Printers, book-binders, etc. A very large business excellently organized for benefit of employés and apprentices.

9. M. Groult. Vitry-sur-Seine, near Paris. "Fabricant de pâtes alimentaires." Good elementary school, for apprentices, (boarders.)

10. MM. Bonnet et Cie. Jujurieux, (Dept. of Ain). Silk spinners and weavers. Employ 450 girls who are boarded, taught and paid 220 to 300 francs a year each. A graphic account of this most excellent institution has been given by Mr. Edwd. J. Watherston in a memoir on The Industrial Employment of Women in France, read before the Social Science Congress in 1878.

11. M. Victor Colcombet. Saint Etienne, (Dept. Loire) Ribbon-weaver. An old established firm employing 320 girls of whom 140 are apprentices. Schools for boys and girls. Excellent dwellings etc. for workpeople. A sort of French *Saltaire*.

12. MM. Chabert et Cie. Chomerac, (Dept. Ardèche). Silk-spinners. Employ 1097 hands, of whom 239 are children. A good school in the factory.

13. MM. Joubert-Bonnaire frères. Angers, Hemp-spinners. School for 140 boys and girls.

14. M. Laroche-Joubert. Angoulême (Dept. Charente) Co-operative Paper-factory. School established many years.

15. M. Alain Chartier. Douai. Glass-works. A school for the 30 apprentices.

16. MM. Thiriez père et fils. Lille. Cotton-spinners. Employ 1500 hands of whom 430 are children. Crèche; kindergarten; orphanage; schools for 85 boys and 148 girls. Good accessory agencies such as insurance clubs, savings bank, etc.

17. M. E. Paris. Bourget, (Dept. Seine). Manufacturer of Plate Glass. School for 35 apprentices, Orphanage, etc.

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Several of the French Railway Companies also possess schools for the juvenile hands in their employ. About these institutions much might be said, especially in relation to other economic problems, from which we must abstain. Suffice it to add that this late development has taken place in consequence of the provisions of a law, passed in 1874, which forbids the employment in the industries of children under 12 except they are actually in receipt of at least two hours' schooling per diem: nor may children over 12 and under 15 be employed for more than six hours per diem unless they have completed their elementary education. The employer is moreover made responsible for seeing that these regulations are complied with. In order to insure this, many employers of labour have organised evening schools on their own premises; and as the law is tolerably elastic in its requirements as to the programme of instruction to be followed during the specified two hours, the character of the education given in such schools has naturally departed more or less widely from the type of ordinary elementary education, and in some instances, as, for example, in the school of M. Soufflot, has even become wholly technical. Let it be also simply mentioned that many of these schools are aided by annual grants of money from the municipality. Those who have most carefully studied the subject speak approvingly of the opportunities thus afforded of continuing the education of apprentices. There is however at present a lack of unity and method in the operation of such schools, and the character and amount of instruction given in them varies very much. The system appears however to be elastic enough to be applied with success to every industry, and a few years will probably witness wide extension and important improvements in this direction. There is however a broad distinction to be drawn between schools for apprentices and apprenticeship schools. Of the former enough has been said; of the latter there is so much to say as to afford ample food for consideration for the present.

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THE WORKSHOP IN THE SCHOOL.

The Workshop in the School offers a second solution to the problem of apprenticeship. So far as I am aware there only exists one school in which systematic manual instruction in a workshop is given to boys who are still going on with their ordinary elementary education. This school, an interesting one in many respects, is the "*Ecole Communale*" in the Rue Tournefort, Paris, which began work in November, 1873. The origin of the manual instruction in the school is interesting. Its director, Dr. Laubier, possesses a great natural taste for mechanical pursuits, and had furnished a back room on the premises with a carpenter's bench and a turning lathe. During a visit of inspection in 1871 these articles were observed, and Dr. Laubier was officially invited to report on the practicability of introducing manual instruction into the elementary school under his charge. His report being ably seconded by M. Salicis,* the cantonal delegate of that *arrondissement*, a sum of 5000 francs annually was voted by the municipality. With this grant in hand Dr. Laubier began to furnish two workshops for teaching the simple elements of wood work and metal work. The following Table exhibits the steady increase that

TABLE I.

NUMBER OF PUPILS RECEIVING MANUAL INSTRUCTION.

1873	13 pupils.
1874	27 ,,
1875	37 ,,
1876	43 ,,
1877	40 ,,
1878	44 ,,
1879	45 ,,

N.B. There is workshop accommodation for 50 pupils. In addition to these there are 315 children in the school not in receipt of manual instruction.

* Author of an extremely able little work, *Enseignement Primaire et Apprentissage*, published by Sandoz and Fischbacher of Paris.

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has taken place in the number of pupils under instruction to the present time.

The peculiarity of this school is that this workshop training is being given to lads who have not yet, for the most part, completed their elementary course of learning. Instead of being abruptly transferred from the literary studies of the schoolroom to the manual occupations of factory life having so little in common one with the other, they are accustomed to pass several hours a day in manual toil, whilst giving the rest of their time to schooling. Two great advantages follow: firstly, they do not run the risk of losing the taste for manual labour by entering on it too late; secondly, they find that schooling and working are not wholly antagonistic, but that on the contrary, each brings something useful to bear upon the other. Three and a half or four hours a day are thus devoted to the workshops, the remainder of the day being occupied with ordinary school occupations. How far this instruction follows the ordinary programme of elementary education may be gathered from Table II, page 18, which gives the scheme of instruction for pupils during their first year in the school.

On reference to this table it will be observed that a very considerable portion of time is given to drawing and modelling, two hours every morning being devoted to this branch of study. For an hour and a half only during the afternoon are these first year's "apprentices,"—little fellows of twelve or thirteen, —employed in the work of the shops. But during the course of their first year they see a good deal, since, by a system of rotation expressly contrived for that purpose, they work for a few weeks at carpentry, then at wood-turning, after that at forging, filing and chipping, and lastly at metal-turning. Not until they have been in the school for eighteen months or two years do the pupils begin to specialize their manual studies on one of these departments of labour. From the day of their entry they receive lessons on the simpler theoretical

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TABLE II.

ROUTINE OF INSTRUCTION DURING FIRST YEAR.

Hours	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7—8	Outline Drawing	same as Monday	same as Monday	none	same as Monday	same as Monday
8—9	Religious Instruction.	History of France	Geography	as on Monday	French Language	Arithmetic
9—11	Drawing, Modelling in clay, Casting in plaster, Sculpture on wood or stone 9—10, Elementary lesson for backward pupils.	as on Monday	as on Monday	as on Monday	as on Monday	as on Monday
11	Recess for few minutes	Recess	Recess	Recess	Recess	Recess
11—12	Reading or Writing	as on Monday	as on Monday	Account Keeping	as on Monday	as on Monday
12—1	Hour for dinner (dejeuner) and recreation.	Dinner	Dinner	Dinner	Dinner	Dinner
1—1-30	Technical lesson. Sketching from drawing on the black-board.	as on Monday	as on Monday	2—4 Drawing, Modelling in clay, Sculpture on wood or stone.	as on Monday	as on Monday
1-30—3	Carpentry, Turning, Forging, according to order of rotation.	as on Monday	as on Monday		as on Monday	as on Monday
3	Recess for few minutes	Recess	Recess		Recess	Recess
3—4	Singing and Music	Drawing of Ornament	Reading from Manuscript		History and Geography.	Exercises in Memory
4	"Tea" (Gouter)	Tea	Tea.	Holiday or else Promenade d'Instruction	Tea	Tea
4-15—5	Gymnastics.	History of Industry or Lesson on Mineralogy	Botany		Zoology	Physics and Chemistry
5—6	Arithmetic, Geometry, Drawing on the black-board.	as on Monday	as on Monday		as on Monday	as on Monday

portions of practical work. A technical lesson is given every day by a master, who illustrates his subject by sketches on the blackboard, duly copied into the note book of every pupil, dealing first with wood, stone, iron, and other materials; then with tools, the element of construction and of machinery, care always being taken to point out the geometrical principles of the machine or tool under consideration. Once a week during the summer months the 'apprentices' are taken to visit some neighbouring factory or workshop to enlarge their ideas and whet their appetite for honourable toil. Let it be recorded as a significant point in the system that one of the highest punishments inflicted for an offence against school discipline is exclusion from the workshops.

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The system of rotation to which we have alluded is pursued with some modifications during the second and third years of the course of instruction. The third table shows in full the system according to which the pupil follows the routine of exercises.

TABLE III.

ROUTINE OF MANUAL EXERCISES SHEWING THE ROTATION OF EMPLOYMENTS.

M. Metal Workers, Smiths, &c.
C. Carpenters, Wood-Turners, and Cabinet Makers.
P. Modellers and Sculptors.

Days.	Modelling and Sculpture.		Carpentry, Turning, Forging, Filing, &c.	
	9—11 o'clock.	1-30—3.	9—11.	1-30—3.
Monday ...	All pupils of 1st yr. P of 2nd and 3rd yrs.	P of 2nd and 3rd yrs.	M & C of 2nd and 3rd yrs.	All pupils of 1st yr. M & C of 2nd and 3rd yrs.
Tuesday ...	same	same	same.	same
Wednes. ...	same	M & C of 2nd and 3rd yrs.	P of 2nd and 3rd yrs.	same
Thursday. .	same	P of 2nd and 3rd yrs.	M & C of 2nd and 3rd yrs.	same
Friday	same	same	same.	same
Saturday. .	same	M & C of 2nd & 3rd yrs.	P of 2nd and 3rd yrs.	same

Having thus followed out the occupations of the pupils of the school, let us next enquire into the nature of the work executed by them. There are three workshops, one for modelling and sculpture, one for wood, and one for iron work. In the first, eight or ten little fellows of various degrees of proficiency may be seen busily shaping their clay models following either plaster-casts or boldly executed drawings, under the superintendence of an accomplished master-workman. A few who have already attained some skill are beginning wood-carving or carving in a soft and easily managed stone. It is

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the very best kind of exercise for the eye and hand of the skilled workman. In the workshop for wood two carpenters and a cabinet-maker superintend the pupils who are beginning to learn the mysteries of their art. Too young to have the strength requisite for heavy work, the pupils are chiefly occupied in learning to make the various kinds of joints, mortised, mitred, and dove-tailed, that are employed in the construction of wood work of all kinds. They execute neat little models of all these; they put together little picture-frames with handsome mouldings, and panelled doors; they also cut geometrical solids and turn simple forms such as tool-handles and chair-legs, and set up little pieces of inlay-work. It is not much as a visible result, not much either as to marketable value, nevertheless of the very highest value as a training of hand, eye, and mind for the career that is to open out hereafter. For names and uses of tools once learned, and a certain skill of fingers once acquired, will never be forgotten or found useless. A few larger pieces of work have been made from time to time by older pupils, each contributing his quotum of labour. In the workshop for metal the pupils work at the forge, learning to make bolts and nuts, to forge and repair tools, and to execute small pieces of work from drawings furnished beforehand. Having done this they go on to learn the use of the file, beginning with the task, so easy in appearance so difficult in fact, of filing into shape a perfect cube. Other simple forms follow, and then they must learn, as they did for wood, the various ways of joining two pieces together, the various systems of rivetting and mortising that are in vogue. This particular branch of work they have carried to a considerable degree of success, so much so that the celebrated School of Military Engineers in Paris, the *Ecole Polytechnique*, has recently given to the apprentices of this school a commission to execute a complete set of models in wood and iron of all the various kinds of joints known.

The results of this system of technical instruction are extremely interesting. Lads who leave the school after their

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three years course of instruction at the age of fourteen or fifteen possess, not only the ordinary elements of school knowledge, but, in addition, a most valuable bundle of useful capacities at their fingers' end. As to their ordinary school knowledge, up to the present time the pupils of this school have done quite as well in their examinations as the scholars from other schools where no manual instruction is given, with the exception of the present year during which exceptional circumstances appear to have operated prejudicially. Nevertheless this year the scholars have acquitted themselves with distinction in several directions in competition with other schools, notably in singing and in drawing.

As to their technical knowledge, it is quite evident that, giving only at most four hours a day to work in the shops, and leaving at the age of fourteen and a half or fifteen years, the pupils will still have, or at least in the majority of cases, to serve a regular apprenticeship in some business. It is admitted on all hands that the training afforded by this school is only preparatory to and not a substitute for an apprenticeship of the ordinary type. It must be remembered that nothing is made for sale in the workshops of the school, and that the object in view is not to produce valuable work but to form intelligent young workmen. This one fact alone suffices to explain why it should be needful for the intelligent young workman to have some further experience in a workshop where neither time nor material must be wasted, even for the sake of improving his manual skill, and where everything else must be subordinated to the exigences of business and the prompt execution of orders in hand. Yet the fact that in the majority of cases some further apprenticeship is needed must not be understood as condemnatory of the system: far otherwise. It was the hope of the founders of this school that one result might be that the long and useless years of apprenticeship might be shortened to pupils who went out from this school. And, except in the rare case of apprenticeship under hard and covetous masters, this antici-

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pation has been fulfilled. The training already passed through absolutely cuts off those first hopeless and idle months of ordinary apprenticeship in which the young novice, surrounded by unfamiliar sights, and set to unfamiliar and distasteless work, wastes his hours in spoiling the material of his master, or in running errands as general drudge, acquiring proficiency only in those lessons of corruption that hours of idleness in a crowded workshop too often teach. From the first the young apprentice from the school in the Rue Tournefort will earn something, perhaps two francs or two francs and a half a day; and there are those among them who in six or eight months after leaving the school are paid as regular workmen. They have not learned their trade in the school, but they have learned how to learn it; and that is something.

From the exhaustive report of M. Gréard, the late able and energetic Director of Primary Education in the Department of the Seine, the statistics of the present occupation of those who have left the school up to August 1878, as shewn in Table IV., have been drawn.

TABLE IV.

RESULTS OF THIS INSTRUCTION.

	The number who have left the school up to 1878 is - - - - - 94, of whom
5	continue their studies in the higher municipal schools.
16	are in one or other industry in wood.
20	,, ,, in metals.
22	occupied in other industries.
14	employed in houses of business as clerks, &c.
17	whose occupation is unknown.
94	Total

"Our apprentices, being at once fit for useful work on entering the factory, are less often employed to run errands; they are better treated, steadier. I could tell you of young lads of fifteen who are actually earning two francs and a half and two francs seventy-five centimes a day, and who in six months more will be paid as regular workmen." *(Extract from letter of the Director, Dr. Laubier.)*

Of the twenty-two who have gone out into other industries,

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it should be said that most of them are profiting by the practical education which they have received, in such trades as that of working jeweller, portmanteau-maker, cooper, etc.: though there are others of whom this can hardly be said, as, for example, of one who has been apprenticed to a wine merchant. In all the constructive industries, however, the value of such a training is very great; and in the school workshops no pains are spared to make each workman as independent as possible. He learns to repair, and in some cases to make, his tools. He has learned to be independent of machinery, for there is no steam engine and few machine tools in the workshops. He has learned something of thrift, for economy is the order of the day in the workshops. There is a savings-bank, a branch of that valuable Parisian institution the *Caisse des Ecoles*, established in the School; and some of his school rewards for good work have been in the shape of additions to his savings, not to be touched till his course is completed.

In short, though there are many points in which there is scope for improvement, notably in the matter of workshop space, and in precision of work, it cannot be doubted that there are many excellent elements in this School.

Lastly as to the cost of this experiment. The author of this paper has, thanks to the kindness of Dr. Laubier, obtained the statistics of the various items of expenditure of the School which are embodied in Tables V. and VI. below.

From these tables it would appear that the cost of the ordinary instruction per head in this school is £1 12s. 5¼d., a sum not very different from the average cost of schooling per head in the other elementary schools of Paris and in the Board Schools of England. The cost per head of the manual instruction is £6 6s. 10d.; or altogether £7 19s. 3¼d. per head. These figures would be very considerably diminished were the number of "apprentices" larger than it is. The importance of these figures we shall discuss at a later stage.

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TABLE V.

COST OF MANUAL INSTRUCTION.

	£	s.	d.	fr.
Salaries.				
Director (for supervision of workshops) ..	40	0	0	1000
1 Smith (2 hours a day 5 days a week, for 10 months)	24	0	0	600
1 Fitter	24	0	0	600
2 Carpenters	48	0	0	1200
1 Cabinet Maker	24	0	0	600
1 Sculptor and Modeller (6 days a week 11 months)	80	0	0	2000
Other assistance	6	4	0	155
Total Salaries	246	4	0	6155
Tools	5	16	10½	146
Materials (Wood and Iron)	16	12	9½	416
Instruments, Books and *Sundries*	16	14	4½	418
Salaries (as above)	246	4	0	6155
Total ..	285	8	0	7135
Grant per annum (5000 fr. in 1873-4)	320	0	0	8000

The total grants up to the end of 1878 have been 42,000 francs or **£1680**, or on the average 7000 francs, or **£240** a year. Out of these grants the workshops have been furnished bit by bit: but no precise data as to the amounts that should be regarded as capital outlay exist.

TABLE VI.

AVERAGE COST OF SCHOOLING AND MANUAL INSTRUCTION.

The cost of schooling of the 360 pupils including the 45 "apprentices" is (approximately) as follows;

	£	s.	d.	fr.	c.
Director, (3000 francs and lodging), say ..	180	0	0	4500	0
7 Masters, Salaries (and allowance for lodging)	164	0	0	4100	0
Rent of School Premises	180	0	0	4500	0
Expenses of Cleaning, Repairing, &c. ..	40	0	0	1000	0
Concierge	20	0	0	500	0
Total .. .	584	0	0	14600	0
Average cost of Schooling for each of the 360 children	1	12	5¼	40	55
Total cost of Manual Instruction for 45 "apprentices" (Table V.) ..	285	8	0	7135	0
Average Cost of Manual Instruction of each "apprentice"	6	6	10	158	55
Total Annual Average Cost of each "apprentice"	7	19	3¼	199	10

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THE SCHOOL AND THE WORKSHOP SIDE BY SIDE.

The School and the Workshop side by side so organized that the hours given to study should be co-ordinated with an equal number of hours devoted to systematic manual instruction, constituted the third of the four possible methods of regenerating the training of the young artisan.

France affords two admirable examples of this kind of school; one the *Ecole Municipale d'Apprentis* of Paris situated in the *Boulevard de la Villette*: the other the *Ecole Municipale d'Horologerie* of Besançon. To each of these schools we will refer in detail, as each is very important. Believing this kind of school to be *the Apprenticeship School* of the future, we think it will be of interest to compare these two examples, both excellent in their way. The one prepares apprentices for several distinct trades, the other devotes its efforts to one particular industry. Hence though the ruling ideas and the methods of instruction have much in common, the matters taught differ widely, the practical exercises being special to the particular industry taught to the apprentice. As in the case of the Elementary Manual School of the Rue Tournefort, so with each of these, we will first describe the aims and organization of the school and of its workshop, and afterwards discuss the results obtained and their cost.

The *Ecole Municipale d'Apprentis*, of Paris, was founded in January, 1873, at the instance of M. Gréard,* and is under the direction of M. Müller formerly Director of the *Ecole Industrielle* of Metz.

This school differs from the Ecole Communale of the Rue Tournefort in several particulars. In the first place the "apprentices" are older, none being admitted under thirteen nor over sixteen, and those who have not already obtained the certificate attesting that they have completed their elementary

* Vice-Rector of the *Académie* of Paris, and late Director of Primary Education for the Department of the Seine.

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education are admitted only after an examination of about an equal standard of difficulty. Secondly, a much larger proportion of time is given to the workshops which here are also more extensive and complete. Though there is no contract of apprenticeship, the course of training, instead of being merely preparatory, is a real three years' initiation into the handicraft taught; and the majority of the pupils on leaving the school step at once into the ranks of able workmen. The education in the schoolrooms being disembarrassed of the dead weight of elementary studies is to a considerable extent specialised in the direction of technical subjects, as will hereafter be explained.

The premises of the school, situated at No. 60, Boulevard de la Villette, were formerly occupied by a manufacturer of aneroid barometers as a factory. The schoolrooms have been added in an adjacent block, and additional workshops are at present being erected. Including the central playground the premises cover four thousand square yards. As in all the municipal schools of Paris the education is entirely gratuitous. The pupils have not even to pay for their tools, which remain the property of the school, unless, as frequently happens, the pupil himself buys them on leaving. On the other hand the apprentices are not paid beyond a trifling gratification of a few pence, bestowed fortnightly and always in proportion to the satisfaction given by the pupil's work and conduct, and of which half is always retained in the savings bank of the school. The annexed Table No. VII. shows the steady growth of the school from its foundation to the present time, when there are upwards of two hundred and thirty pupils.

The rapid increase in the number of scholars during the last two years has more than kept pace with the available accommodation. The manual instruction given in the school is conducted in two principal workshops, one for workers in wood, the other for workers in metal, together containing places for one hundred and seventy-five pupils distributed in the manner indicated in Table VIII.

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TABLE VII.

NUMBER OF PUPILS IN THE SCHOOL.

1873	January	6.	17
1873	May	1.	64
1874	,,	,,	104
1875	,,	,,	119
1876	,,	,,	129
1877	,,	,,	149
1878	,,	,,	165
1879	,,	,,	221

Note. The number in July 1879 reached 230

TABLE VIII.

PLACES FOR PUPILS (MAY 1ST, 1879).

92	Vices	affording accommodation for	92
41	Benches	,, ,, ,,	41
4	Forges	,, ,, ,,	16
12	Lathes (Metal)	,, ,, ,,	12
4	Lathes (Wood)	,, ,, ,,	12
	Attending to the Engine	1 Engineer	1
		1 Stoker	1
Total Number of Places in the School			175

NOTE. During the three months succeeding, this number was augmented to 230 by the completion of additional lathes, benches, etc., constructed by the apprentices themselves.

The trades in which direct instruction is thus given are six in number; viz: carpenter, wood-turner, pattern-maker, smith, fitter, and metal-turner. An extensive workshop for locksmiths has been opened during the present year, also a workshop for makers of philosophical instruments, or *instruments de précision*.

An apprentice who enters the school spends at first only five hours and a half, per diem, in the shops; and during his first year follows a fixed system of rotation, first in the workshop for wood, then in the workshop for metal. After trying his hand at carpentry for say six weeks, he will spend a couple of months in filing and chipping; after that proceed to wood-turning, and so make the round of the various occupations in a preliminary way, picking up a general acquaintance with all of them, and

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executing under careful direction a course of preliminary exercises in each. His first year over, he makes his choice, and settles down to steady work at one department, his hand and head being alike benefitted by the variety of experience he has seen. Henceforth the work which he executes will possess some intrinsic worth apart from the value it has had as a means of training him in its execution: henceforth, too, he spends a larger proportion of time in the workshops. Apprentices of the third year give seven and a half hours to the shops, three hours to studies general and technical. The routine of daily employments for pupils of the first, second, and third years is given in Table IX.

Let us examine a little more narrowly the nature of this workshop instruction. Enter the workshop on the ground-floor and you find yourself in the presence of about a hundred healthy looking lads who are hard at work on their tasks. All down one side of the long room are ranged benches and vices for the apprentice fitters. In the centre and at the nearer end, the lathes for metal-turning, the planing machine, machines for drilling and punching, and a universal shaping machine. Overhead runs the shafting that brings the power from the motor, a semi-portable steam engine of eleven horse-power, placed in an adjoining shed. It is managed by the apprentices themselves, the third year's pupils acting week-about as engineer, with a second year's apprentice as stoker. At the far end of the room are the forges. A young and stalwart smith is busy instructing three novices in the art of striking. Hard by, another group are at work by themselves forging a hammer head;—and forge with right good will and judgment too. Two master-workmen suffice to superintend the fitters and metal-turners; for every apprentice has had his day's work allotted by the *Chef des Travaux*, and knows how to set about it. No piece of work does any pupil undertake which has not already been the subject first of a rough pencil sketch with the dimensions scribbled upon it, and afterwards of a finished "working-drawing" taken

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TABLE IX.

SCHEDULE OF DAILY EMPLOYMENTS.

	7—8	8—1 & 2—2.30		3—4	4—5	5—6	6—7
MON. .	Study	Workshops	1 2 3	Study Geom. Drawing Workshop	Geom. Drawing Study Workshop	French Geometry Sketching	Geometry English Industrial Law
TUES...	Study	Workshops	1 2 3	Drawing Tools Workshop	Drawing Study Workshop	Study Algebra Mechanics	English Hist. or Geog. Descr. Geom.
WED. .	Study	Workshops	1 2 3	History Drawing Workshop	Chemistry Drawing Workshop	French Geometry Drawing	Geometry Physics Drawing
THUR .	Study	Workshops	1 2 3	Reading French Workshop	Geography Chemistry Workshop	Arithmetic English Physics or Chem.	English Arithmetic Technology
FRI. ...	Study	Workshops	1 2 3	Drawing Mechanics Workshop	Drawing Book-keeping Workshop	French Geometry Mechanics	Geometry Study Sketching
SAT. ...	Study	Workshops	1 2 3	Tools Drawing Workshop	Arithmetic Drawing Workshop	Physics French Drawing	Study Study Drawing

out to scale with ruler and compasses. Each pupil has his drawing beside him. His work when finished is noted down on the record; and his name is affixed to the article he has made, together with other particulars, such as, for example, the number of hours he has taken to complete it. The exercises he has to execute are chosen in accordance with a predetermined list, increasing in difficulty as his hand acquires practice. This gradual transition from the easiest to the most difficult tasks, so impossible in the ordinary neglected and irregular apprenticeship of the shops, is the surest way to excite in the budding artizan the ambition to excel, and is the source of an enormous

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saving of time in his apprenticeship. The preliminary year of rotation has already sorted out the youths according to their capacity; unimpeded by having a distasteful occupation forced upon them, those who follow out the second and third years of their course make surprising progress. The greatest attention is paid to precision of work. Rules of thumb are absolutely forbidden: the workman must do nothing without knowing why he does it. His tools must be made of a particular shape, their angles ground to a particular number of degrees, not because such has always been the traditional practice of the shops, but because such and such a shape can be shown to give the greatest strength compatible with least material, or because the particular angle prescribed is the one which experiment proves to be most effective for the work to which the tool is to be applied. M. Bocquet, the *Chef des Travaux*, is a great admirer of Rouleaux, and has practically carried out in the work of the apprentices under his charge many valuable suggestions to be found in his justly celebrated treatise on machinery. In the machines of this workshop there are several which embody new inventions: we notice particularly a planing machine, made by the apprentices themselves, with a novel and beautiful automatic contrivance for lifting the tool during the return; and an elegant application of the principle of the screw in a simple and safe piece of gearing to set some of the heavy lathes into action.

If we ascend to the workshop for wood we find the same spirit of industry and intelligence pervading the work. The exercises of the apprentices are just such as young carpenters and young pattern-makers in English shops would go through sooner or later, but systematised both as to the order in which they are to be executed and as to the methods to be followed in their execution. Here, too, all work is executed precisely to scale, and from working-drawings previously made by the pupil. It is the very soul of intelligent and exact work.

The hours spent in the schoolrooms are devoted to studies

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which so far from injuring the capacity of the workmen for his work aid him mightily. For the first year, and in part of the second, the ordinary subjects of arithmetic, geography, history, etc., still claim some attention. The elements of general culture must not be suffered to lapse into oblivion because the scholar has become a workman. But in addition to these subjects there are lessons in others more akin to the employments of his working hours, the special object of which are to help his apprehension of the scientific and technical principles that underlie his work; and by instilling these into him to free him for ever from the thraldom of rules of thumb. From the first he will attend a course of 'Technology.' He soon finds this very terrible term to become comprehensible. M. Bocquet who is his teacher for this subject, he already knows as his master in the shops; and when he begins with a preliminary discourse in very simple language about wood and iron and other materials, their properties, defects and cost, the pupil follows without difficulty. Then come lessons on the rudiments of machines, nuts, bolts, axles, etc., chiefly descriptive. After that, tools are treated of, at once simply and scientifically. In the third year the course of Technology takes the form of lessons on steam engines and machine-tools. Every lecture is illustrated by black-board sketches which each pupil reproduces in his note-book. They form a precious record and work of reference, not to be parted with by the pupil for a considerable sum; and the object of some envy and frequent borrowing on the part of past scholars whose notes were less perfect. It is an excellent system, and valuable beyond reckoning to the hearers. Other studies claim their share of attention. Industrial Chemistry takes an hour every week. English is not quite overlooked. Mechanics comes in for a double portion. Descriptive Geometry and Geometrical Drawing claim a lion's share: a particularly excellent course of lessons in this subject being undertaken by the director M. Müller himself. Physics, chiefly from the point of view of its practical applications, is also taught;

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M. Amaury, an accomplished assistant in the Observatory of Paris, being charged with this course.

And what is the result of the education which we have been following so carefully in detail? Simply this: that *on leaving the school the young workmen are at once in a position to earn a sum equivalent on the average to eighteen shillings a week, their average age being seventeen years and a half:* some of them earning much more. There is no doubt or haziness about this statement, because we have happily the means of making a precise average. At the end of 1878, of the *seventy-four* apprentices who up to August, 1877, had completed their three years' course and gone out, one was dead, one was continuing his studies, one only was of unknown occupation, two had gone into business houses as employés, *sixty-nine remained faithful to the industry they had learned in the Apprenticeship school.* In the remarkable Report of M. Gréard on Primary Education in Paris* a list of these past pupils is given, together with their age, occupation, place of employment, and salary. From that list, aided by additional information afforded by the kindness of the director, has been compiled the following Table No. X.

As a further illustration of the information thus afforded as to the practical results attained by this system we take (as they occur in alphabetical order) the last five apprentices who left the school in August, 1877, and their wages in 1878.

Charles Reiff, 19, Fitter, Place du Trône, wages 5 francs 50 c. per day of ten hours. (4s. 4½d.);

Henri Richard, 17, Pattern-Maker, 17 Rue des Gobelins, 3 fr. 50 c. (2s. 9½d);

Emile Tavernier, 18, Turner in Metals, 1 Boulevard Macdonald, 5 fr. 50 c. (4s. 4½d.);

Georges Valuet, 17, Pattern-Maker, Maison Farcot, 3 fr. 80 c. (3s. 0½d).

Auguste Weiss, 17, Smith, 7 Rue Oberkampf, 6 fr. 70 c. (5s 4½d).

* L'Enseignement Primaire à Paris, de 1867 à 1877. Second Edition, 1879.

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TABLE X.

NUMBER OF PUPILS WHO HAVE LEFT THE SCHOOL, AND THEIR AVERAGE WAGES.

	1875.		1876.		1877.		1878.	
	Left Aug. 1.	Average Daily Wages.	Left Aug. 1.	Average Daily Wages.	Left Aug. 1.	Average Daily Wages.	About to leave.	
		s. d.		s. d.		s. d.		
Fitters ..	12	3 3¼	14	3 6¼	16	2 4¾	14	Many of these apprentices had already secured good situations before leaving, some being engaged months before: but no reliable average has been available as yet.
Smiths ..	2	3 9	0	—	2	4 0½	4	
Metal Turners	2	3 8	1	3 11½	3	3 6¾	0	
Carpenters	0	—	3	3 9	1	1 11¾	0	
Pattern Makers	4	3 3	7	3 8½	6	2 9¾	7	
Wood Turners	1	?	0	—	0	—	0	
Totals	21		25		28		25	
Average age (1878).	19 yrs. 4½ mo.		18 yrs. 6¼ mo.		17 yrs. 6 mo.			
Average Wages per day (1878).	3s. 4½d.		2s. 10¾d.		3s. 1½d.			

N.B. These sums are calculated reckoning 1 franc = 9½ pence.

It will be noted as an evidence of the internal progress of the school that the scholars of the third promotion, though younger by a year, were actually earning more than those of the second promotion who had been a year longer working for themselves.

Independently of the evidence afforded by these figures the almost universal testimony of engineers and of educators in Paris is favourable to the results attained by this remarkable school. The objects constructed in the workshops by the pupils attracted considerable attention at the International Exhibition of Brussels in 1876; and the exhibit of the school at the *Exposition Universelle* of Paris in 1878 was truly remarkable. The objects collected in the central Pavilion of the

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Ville de Paris comprised an excellent ribbon saw, a large planing machine, a drilling machine, several lathes, an admirable collection of drawings, together with many tools, models, etc., illustrative of the system of instruction.

We must next turn to the question of the cost at which this education is given. We have already remarked that it is gratuitous. The entire charges are borne by the municipality of Paris.

The land with the original buildings cost £16,000: the additional buildings and the necessary alterations cost £12,000. As a matter of fact there is much more land than is actually needful for the school. The sums paid for furnishing the schoolrooms and equipping the workshops were £223 and £1879 respectively. The separate items will be found in Table XI adjoining.

TABLE XI.

CAPITAL OUTLAY ON SCHOOL. (Up to May 1, 1879.)

	£	s.	d.	fr.	c.
Land (and buildings)	16,000	0	0	400,000	00
Buildings and Alterations	12,000	0	0	300,000	00
Average outlay on land and buildings per boy (175 places)	160	0	0	4,000	00
School Fittings.					
Furniture and Fixtures of Schoolrooms	46	16	6	1,169	95
Office-fittings for Director, etc. ..	36	17	4	920	80
Sanitary Fittings	40	0	0	1,000	00
Library Books, Maps, Copies, etc. ..	83	14	5	2,092	50
Forms and Registers	16	0	3	400	30
	223	8	6	5,583	55
Workshop Fittings.					
Vices (92) for fitters and smiths .	466	1	5	11,651	80
Lathes for metal work (12 in all) ..	430	16	0	10,770	0
Slotting, Planing, Drilling Machines Ribbon Saw, etc.	257	8	0	6,435	0
Forges (4) with bellows, anvils, etc., complete	172	16	0	4,320	0
Benches (41) for Carpentry and Pattern Making	153	15	2	3,843	75
Lathes (4) for wood turning	76	9	2	1,911	50
Steam Engine, Shafting and Pulleys ..	322	0	0	8,050	0
	1,879	5	9	46,982	5
Total outlay on School and Workshop Fittings for 175 boys	2,102	14	3	52,565	60
Average per boy	12	0	3¾	300	37

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Reckoning the number of available places as 175, it follows that the average capital outlay per apprentice has been: for land and buildings £160; for schoolroom and workshop fittings £12. The whole of the expense of workshop fittings was not incurred at the outset; the shops having been furnished piece by piece, by the apprentices themselves, from the materials bought year by year. As the expense of equipping the various workshops is very different, the several averages per available place are given separately in Table XII. From this table it

TABLE XII.

AVERAGE CAPITAL OUTLAY ON PUPILS IN WORKSHOPS OF SEPARATE DEPARTMENTS. (not including school fittings.)

	£ s. d.	fr. c.
Metal Turner	35 18 0	897 50
Smith	10 16 0	270 00
Wood Turner	6 7 7	159 30
Fitter	5 1 4	126 65
Carpenter or Pattern Maker ..	3 15 0	93 75
Average capital outlay on Workshops per pupil (175 places) ..	10 14 6	268 47

NOTE. The data of capital outlay on the recently added workshops for Locksmiths and Makers of Philosophical Instruments (Instruments de precision) have not yet been published: but they cannot be very heavy, as most of the necessary appliances, the vices, benches, and lathes of special form, have been constructed by the apprentices themselves in the existing workshops.

would appear that the outfit of the metal turner is the most costly, the expense of the machine lathes with their slide-rests and appliances mounting up heavily. Not including the cost of schoolroom furniture, the capital outlay per place in the workshops (reckoned as 175) is £10 14s. 6d. As, however, the number of available places is being continually increased by the manufacture in the shops of new lathes, benches and vices, this sum must be considered as tending constantly to diminish as the school grows.

The annual sum required to maintain the school in operation exceeds two thousand pounds. Salaries amount to £1,287, and

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the value of materials supplied to the workshops £1,116. Table XIII gives the exact sums; and shews that the average yearly

TABLE XIII.

ANNUAL EXPENDITURE. (1878).

	£	s.	d.	fr.	c.
Salaries	1,287	10	0	32,190	0
Materials	1,116	0	0	27,900	0
Total	2,403	10	0	60,090	0
This sum divided between the 221 actual pupils gives:					
Average yearly cost of pupil.. ..	10	17	6	271	90

cost to the municipality of each pupil (reckoned at 221, the actual number, May 1) is £10 17s. 6d. It must be remembered however, that a large part of the £1,116 spent on materials is really devoted to completing the outfit of the workshops, since the machines which have been mentioned, the planing-machine, ribbon-saw, drilling-machine, etc., made by the pupils themselves, are retained in the school, and their actual cost is set down under the item workshop fittings in the capital outlay detailed on Table XI. The apprentices have also constructed large massive oak cases for the school library. In addition to this, several thousand francs' worth of objects, geometrical models, and models of machinery, etc., are retained by the municipality for use in the municipal schools; and some are sold to outsiders, the receipts from this source going to the municipality, not to the school. Thus in 1878 the actual sales amounted to four thousand francs, and a large collection of models was furnished to the Apprenticeship School about to start operations at Lille. Up to the month of July the value of the objects fabricated during the present year exceeded twelve thousand francs. It is difficult to ascertain or even estimate what proportion of the £1,116 paid for materials should be regarded as a capital expenditure.

We may arrive at a final estimate of the entire annual cost to the city of each apprentice, by adding to the actual annual

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outlay a percentage on the value of the capital invested, reckoning seven per cent on the capital represented by land and buildings, fifteen per cent on that sunk in furniture and machinery. The result is as follows:

	£	s.	d.
Seven per cent on Land and Buildings	1960	0	0
Fifteen per cent on Furniture and Machinery ..	315	6	0
Salaries and Materials, ...	2403	10	0
Total ..	£4678	16	0

This sum divided by the number of pupils, (say 221,) gives £21 3s. 5d. as the average annual cost to the municipality of each pupil. A yearly fee of that amount paid by each pupil would suffice to render the institution self-supporting.

Before passing entirely from this most interesting school a few words on some points in its scheme of education may not be out of place. As it is designed not to educate foremen or masters, but solely and simply to make good and intelligent workmen, there is little attention paid to scientific instruction properly so called; and those scientific subjects which appear in the curriculum of Table IX, Mechanics, Physics, and Chemistry, are treated from the point of view of their practical application. The circumstance that time can be found to devote to these and other technical subjects arises from the rule that all who enter must have completed their elementary education. It will be remarked by readers accustomed to the ways of English schools, how little time is devoted to the subjects, Arithmetic, Reading, History, and Geography. We are apt to forget that English children still labour under the burden of the dismal chaos which we denominate our 'system' of weights and measures; and that this practically means that they waste about a year of their elementary schooling, which is saved for French children by their having instead the metric system. Also, that the French language is almost purely phonetic, and that a child who can spell can read; whereas, with our un-reformed and un-phonetic spelling at least another whole year is wasted out

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of the time given to elementary schooling. The neglect of History and Geography is only what occurs in almost all French schools, and is certainly a defect. Another point which the reader will have noticed is the large amount of time devoted to Geometry and Drawing. In many skilled industries Geometry indeed almost takes the place of Arithmetic and Algebra, and it is absolutely essential to all exact and intelligent construction. Some workmen who never have had it taught them, contrive, if they are more than usually intelligent, to pick up for themselves many of the practical methods to which theory would lead. The writer was assured a few months ago by the late Mr. Froude, the eminent naval architect, that intelligent workmen do thus arrive at a knowledge of the elementary applications of the differential and even of the integral calculus. But those workmen who thus arrive, almost intuitively, at practical methods without having been taught the subject, are usually unable either to give any reason for their practice, or even to impart their methods to their fellows. As to Drawing, let it be remembered that drawing is the language of the skilled constructive industries, just as essential to them as reading and writing are to general commerce. By the term *drawing* is meant, not 'outline drawing,' nor 'perspective drawing,' nor yet 'mechanical drawing' (so called), but that system of drawing which has been adopted as the most convenient for conveying to a workman the dimensions and form of an object he has to construct—the system in short according to which the "working-drawings" of engineers are constructed, the theoretical processes of which are known by the stilted and pedantic name of "orthographic projection." Unfortunately the construction of "working-drawings" has never been systematised in any English school. It does not correspond to any one of the "Subjects" of the South Kensington Examinations, though it implies a knowledge of some of the elements of each of them. "Working-drawings," giving plan and elevation and perhaps one or more other views of an object, cannot be drawn except

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by a person who knows something of Plane Geometry, something of Solid Geometry, something of Model Drawing: but they may be executed either precisely with ruler and compasses or roughly by the unaided hand, provided only that they shall unmistakeably convey the relative dimensions and positions of all portions of the object. The term "Industrial Drawing" has been well applied to the science and art of constructing working-drawings. The success of the La Villette apprentices is largely due to the excellence of the system under which they are taught this the mystic universal language of skilled labour. It is the very soul of true Technical Education, and of exact and intelligent workmanship. Their system is in brief as follows. The master first draws on the black-board a rough working-drawing in freehand,—we will call it a "sketch." The pupils copy, also in freehand. No such thing as a ruler or compasses is allowed. The master then "figures" his sketch, i.e., indicates its dimensions, curves, etc., by appropriate numbers written down on its various lines. The pupils "figure" their sketches. The master then rubs out his sketch. The pupils retire to their own desks, take out ruler and compasses, and from the dimensions marked on their sketches proceed to make out a finished working-drawing to scale. This done, the object must be then actually made in wood or iron. Easy objects first, difficult objects afterwards, form the subjects of the lessons. Sometimes the procedure is changed, and the pupils are set to sketch a simple bit of machinery; to measure it and figure their sketches; then to execute a finished drawing to scale. These details may seem trifling. On the contrary the matter is of vital importance. Technical Education without education in technical drawing is a delusion and a sham.

After this digression let us conclude our remarks on the educational programme of the school with one sentence calling attention to a feature of importance. One hour a week is devoted to instructing these future workmen in the rudiments of Industrial law; a practice which finds a parallel in our

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medical schools in the courses of medical jurisprudence delivered to our embryo physicians.

The following extracts from the Memoir of M. Gréard* on Apprenticeship Schools, written when the school of La Villette was being organized, will appropriately close our notice of the school: they have served as the basis of its organization from first to last.

"No premature admission; the physical strength no less than the intellect of the child not admitting before a certain age of the serious education of apprenticeship.

"No too considerable agglomeration of pupils, nothing being more demoralising.

"No rapid specialisation; the hand and the mind alike deriving unmixed gain from the generality of exercise.

"No school fees, the institution being designed for the poorest classes; but no board or lodging provided, as the family ought to keep charge and have the honour of following the education of the child.

"No exercises prolonged until body or mind are fatigued; variety of exercises being one of the conditions indispensable for the well balanced development of the physical, intellectual, and moral powers of the apprentice.

"No theoretical scientific teaching; since the education of an apprenticeship school ought, if it is to be fruitful, take as its point of departure not theories but facts, and ought to deal with those theories only whose practical application can be demonstrated."

Two other *Ecoles d'Apprentis* of similar type exist in France, at Havre and at Douai. The Havre school, situated in the Rue de la Mailleraie, near the quay, was established in 1867, and has a workshop for metal and another for wood, in both of which good valuable work is executed. The Douai School, though older, is smaller and less active.

The *Ecole Municipale d'Horologerie* of Besançon affords an

* Mémoire sur les Ecoles d'Apprentis, 1871, page 82.

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admirable instance of an Apprenticeship School in which manual instruction in one particular industry is co-ordinated with theoretical instruction in the schoolroom.

Horological Schools exist in France at Cluses, Mâcon, and Besançon. The first two are government schools and are for the education of foremen. They are frequented only by youths of the middle class. The school at Besançon is essentially an apprenticeship school, the bulk of its pupils being drawn from the artizan classes of the surrounding district. Besançon is the centre of the watchmaking industry of France, five-sixths of all the watches that enter the French market being manufactured in the neighbourhood. Its annual produce is nearly half a million watches, over fifteen thousand of the population being employed in the industry. In the year 1860 representations were made unsuccessfully to the French government to establish a school of watchmaking at Besançon. Two years later the municipality took the bold step of founding the school with their own resources. A large building belonging to the town was set apart for the purpose and fitted up to receive 36 pupils: it has since been enlarged to accommodate ninety. The fluctuations in the attendance at the school are given in Table XIV; they are also indicated graphically in Table XVI.

TABLE XIV.

NUMBER OF APPRENTICES IN THE SCHOOL.

1862	15	1871	38
1863	24	1872	59
1864	32	1873	83
1865	19	1874	87
1866	28	1875	81
1867	34	1876	72
1868	41	1877	74
1869	25	1878	63
1870	0*	1879	58

* Note. During the War the school was used as a military post and ambulance hospital.

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The regulations for admission to this school are similar to those of the Ecole d'Apprentis of La Villette. Candidates are not admitted under the age of thirteen, and must prove themselves to have completed their elementary education by undergoing an examination. The education is gratuitous to boys of Besançon, but pupils from a distance must pay a fee of £8 a year. Those who thus come from other places are boarded in the neighbouring *Lycée* at a charge of £32 a year. There are several "scholarships" in the school founded respectively by the *Conseil général du Doubs*, by the Masonic Lodge, the Watch-makers' Guild, (*Cercle de l'horologerie*), and by several of the wealthier manufacturing houses of the district. These scholarships usually take the form of a gift of working tools. The complete course of instruction in the school lasts three years; but provision is made for specialists either to take a shorter course, or to remain for a longer period in the school. The education is two-fold; the apprentices having eight hours a day of manual exercises in the workshops of the school, and either two or three hours of school teaching.

The following extracts from the programme of the school indicate concisely its aims.

Above all the aim of the school is to provide to families a means whereby their children may be instructed in a complete and exact knowledge of Horology: to supply, in a word, the notorious insufficiency of actual apprenticeships. For apprenticeships, defective as they are nowadays from a purely practical point of view, are for the most part absolutely devoid of any theoretical bearing. The programme of the school is to offer an instruction such that in all phases of apprenticeship the young watchmaker may be able to make a constant study and comparison between theory and the results at which practice has arrived.

The course of instruction comprises: the execution by hand of watch-works of various sizes, both rough work and finished, including keyless watches; the fixing of the principal forms of escapement in use; the setting of the jewels; the setting, winding up, and regulating of different kinds of watches; and the development of the principles to be observed in the good execution and repairing of watch-work in general. It also includes lessons in the French language, in arithmetic, algebra, geometry, physics, chemistry, mechanics and cosmography so far as relates to Horology; drawing of machinery, (chiefly pieces of watch-work); and book-keeping.

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Let it be remarked that of these studies Drawing and Geometry obtain by far the greatest share of attention, two hours per diem being devoted to one or other of these subjects. The teaching is committed to a staff of thirteen persons, enumerated in Table XV; from which it will be seen that seven of these

TABLE XV.

STAFF OF THE SCHOOL (1878).

Director	1
Teachers of Theory (Arithmetic, Algebra, Geometry, Physics, Chemistry, Mechanics, French language, Geography, Account-keeping; etc.	3
Practical Teachers*	7
Teachers of Drawing	2
	13

are practical instructors in the workshops, and that two teachers of drawing are employed.

During the seventeen years over which the operations of the school extend, 431 pupils have entered the school, of whom 58 are still (July, 1879) pursuing their course. The 373 who have left are employed, almost without exception, in one or other branch of the Watchmaking industry; the greater part of them at Besançon, even including some of those who were sent by parents from a distance.

The cost of this education is remarkably cheap. We have already remarked that the land and buildings were provided by the town: their rental value cannot be less than £200 a year. The original outfit of schoolrooms and workshops amounted to 10,000 francs, or £400, but this sum has since been more than doubled. The cost of maintenance and interest should not be reckoned at less than £120 a year. The balance-sheets of the school shew that the sums spent on salaries, maintenance and materials, (the last item being inconsiderable,) amount to 25,000 francs, or £1000, per annum. Towards this the fees paid by actual students do not go far. A small part is made up by

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subscriptions, and the municipality pays an annual grant of 12,000 francs or £480. Apart from the capital outlay which cannot be precisely ascertained, it would appear that, taking 58 as the actual number of students, the cost to the municipality of their education is £8 5s. 6d. per head; or, reckoning 90 as the number of available places, the town expects to spend as a minimum £5 6s. 8d. per annum per head.

And what are the results that have followed this self-denying expenditure on the part of the little municipality? The results produced on the pupils themselves are easily told. They are more methodical and intelligent in their work, steadier in general conduct, have a far better grasp of the whole subject, and are pronounced to be much more competent than the average of workmen at executing repairs, since they have learned principles and have not been kept doing one thing—say polishing pivots—all through the years of apprenticeship. They earn two francs a day, on the average, immediately on leaving school; a sum about equal to that of other apprentices when coming to the end of a four or five years' apprenticeship.

The quality of their work is extremely good, excelling in precision and perfection of workmanship, two essentials in watchmaking. The unique and exquisite collection of typical studies executed by the pupils of this school will be vividly remembered by visitors to the Paris Exposition of 1878. Let it be confessed freely that the pupils on leaving school do not generally work as *quickly* as apprentices coming from the shop of a master. But speed of execution comes with time and practice. It is far better to make a *good* workman than a *quick* workman, especially if the latter gains quickness by learning to make nothing but one small piece from year's end to year's end.

But the results which have followed the establishment of this school may be looked at from quite another aspect, viz: from the point of view of the rapid extension of the industry of late years. In Table XVI. adjoining are given in graphic curves the statistics from year to year, firstly of the increase of the

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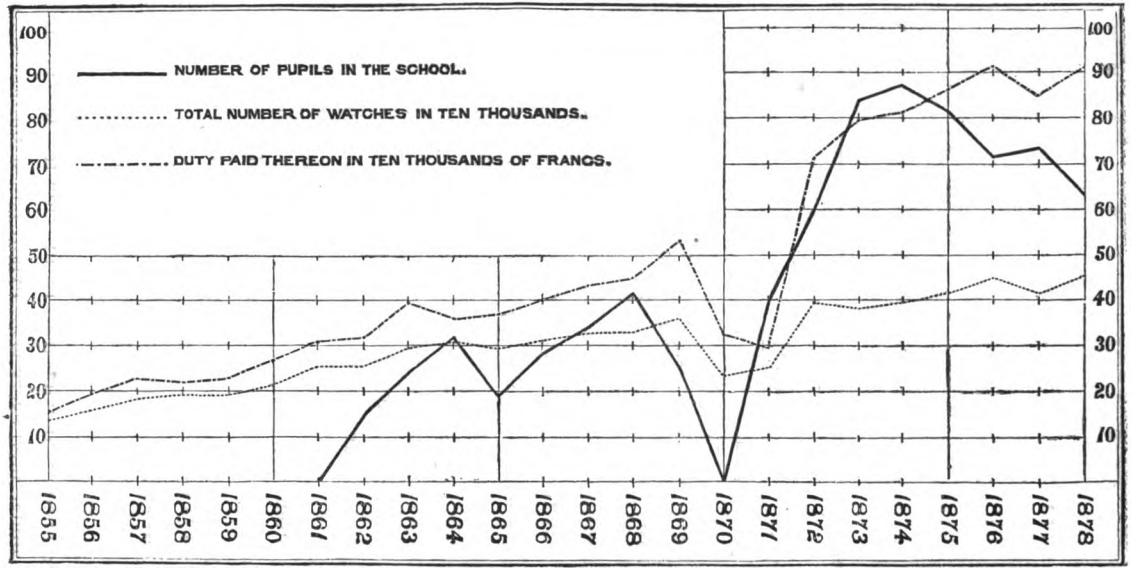
TABLE XVI.

GRAPHIC CHART, shewing progress of the School and Increase in the number of Watches manufactured in the Besançon district and in the amount of duty paid thereon.



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school, secondly of the increase in the number of watches manufactured in the district, thirdly in the amount of duty paid to the Treasury on the watches thus passed through the guarantee office of the municipality. The figures themselves are given for successive intervals of ten years in Table XVII.

TABLE XVII.

STATISTICS OF GROWTH OF WATCHMAKING INDUSTRY IN THE BESANÇON DISTRICT.

Year.	Number of Watches passed through the Guarantee Office of the Municipality.			Amount of Duty paid to the Treasury.				
	Gold.	Silver.	Total.	£	s.	d.	fr.	c.
1846	10,275	52,589	62,864	4,243	4	7¾	106,080	80
1856	60,511	99,654	160,165	7,937	3	9¼	198,429	72
1866	101,309	204,126	305,435	15,972	4	4¼	399,305	52
1876	144,502	311,466	455,968	36,860	15	11¾	921,519	97

From these statistics, kindly furnished by M. Charles Savoye, of the firm of Savoye Frères of Besançon and Paris, we gather that the increase during the ten years from 1866 to 1876 in the number of watches made annually was from three hundred and five thousand made in the former year to four hundred and fifty-five thousand in the latter; and this in spite of the depression during the war of 1870-71. The number of watches turned out in 1856 had been only one hundred and sixty thousand. A still more striking proof that the growth of the industry has been due to the quality of workmanship is afforded by comparing the flow of trade between France and Switzerland in the years 1872-74 with that in the years 1862-64. The figures given in Table XVIII are extracted from the Report of a Swiss Commission which sat at Bienne (Canton of Berne) in December, 1876. From this Report it would appear that the Besançon manufacturers, in addition to the half million watches manufactured every year, export half a million francs' worth of watch movements into Switzerland. A single sentence from the

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TABLE XVIII.

RELATIVE EXPORT AND IMPORT OF WATCHES BETWEEN FRANCE AND SWITZERLAND.

(From the Report of the Swiss Commission at Bienne, Dec., 1876.)

	1862—64.				1872—74.			
EXPORTS from Switzerland to France.	£	s.	d.	francs.	£	s.	d.	francs.
Gold Watches (to value of)	110,793	12	0	2,769,840	10,634	15	2	265,869
Silver Watches	52,060	17	7	1,301,522	21,810	8	9½	545,261
Movements	1,038	9	7	25,962	24,711	5	7½	617,782
Totals ..	163,892	19	2	4,097,324	57,156	9	7	1,428,912
IMPORTS from France to Switzerland.								
Gold Watches	2,108	6	4½	52,708	13,213	3	2	330,329
Silver Watches	244	4	0	6,105	9,575	14	4½	239,393
Movements	11,159	6	4½	278,983	42,905	13	7½	1,072,642
Totals	13,511	16	8½	337,786	65,694	11	2	1,642,364

NOTE. By far the greatest proportion of all watches supplied to the French market are from the Besancon district. Thus in 1876 Besancon supplied 455,668 watches; while foreign importations amounted to about 60,000 only, half of which came from Switzerland. No finished watches are made at Cluses, only portions of movements, pinions, etc, to supply the makers at Geneva and Besancon.

Report suffices to state the case. "These numbers are fearfully eloquent; in ten years our exports to France have fallen from *four millions* of francs to *one million four hundred thousand*; that is to say to less than one third, and, during the same time, the French imports into Switzerland have risen from three hundred and eighty thousand francs to one million six hundred thousand francs, that is to say they have *quintupled*."

It would be idle to pretend that this astonishing increase in the industry of the Besançon district is due solely to the beneficial influence of the Horological School. The school

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itself was founded to aid in developing what was before its foundation a growing industry; and the same energy which created the school had already manifested itself in other powerful ways. There can, however, be no question that the very rapid development of the years 1871-3 would have been impossible but for the excellent work done by the school during the preceding decade. Those who are most intimately acquainted with the industry are unanimous upon this point, and if any further proof were needed it is to be found in certain steps that have been taken in Switzerland to recover the threatened industry. The Swiss have attempted to meet the very serious crisis brought about through the rivalry of Besançon by establishing Apprenticeship schools for themselves. The oldest school of watchmaking is that of Geneva, re-organised by the town in 1843. The little school of Cluses dating from 1848 was resuscitated by Napoleon III in 1863, when Savoy became part of France. The Besançon school dates from 1862. *Since 1862 no fewer than six Horological schools have been founded in Switzerland.* Their localities and dates of foundation are given in Table XIX.

TABLE XIX.

HOROLOGICAL SCHOOLS IN FRANCE AND SWITZERLAND:
With the dates of their foundation.

GENEVA, 1824: re-organised 1843 by the municipality.

CLUSES, (Savoy) 1848, re-organised 1863 by French Government.
BESANÇON, (Department of the Doubs) 1862.

CHAUX-DE-FONDS, (Swiss Jura, Canton de Neuchâtel) 1865.
LE LOCLE, (Swiss Jura, Canton de Neuchâtel) 1868.
NEUCHATEL, 1868.
SAINT-IMIER (Swiss Jura, Canton de Berne) 1873.
BIENNE (Canton de Berne) 1873.
FLEURIER (Swiss Jura, Canton de Neuchâtel) 1874.

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A project for founding in Paris a Horological school on the type of that we have now described, has several times occupied the attention of the Syndical Chamber of Watch-makers of Paris. The project has not yet however been carried out.

The system which here is applied with so much success to the education of apprentices in the particular industry of watch-making, and which is almost identical with that applied in the wider and more general curriculum of the *Ecole d'Apprentis* in the Boulevard de la Villette, is doubtless equally applicable to other trades and industries. The writer learns from the personal testimony of some of the most eminent jewellers and goldsmiths of Paris that a school similar in character to the Besançon school or to that of La Villette is much needed in Paris in the industries that deal with the precious metals. The need is distinctly foreshadowed by the fact that several large houses in Paris have recently established evening schools in drawing and modelling, etc., for their apprentices; as for example M. Soufflot of the Rue du Quatre Septembre, M. Hémon of the Rue du Temple, and MM. Savard of the Rue Saint Gilles. The *Chambre Syndicale des Bijoutiers et Orfèvres* has also established an evening school for drawing and modelling in the Rue Saint Martin, which yields, as the writer can personally testify, excellent results. One such school would suffice to train apprentices in the skilled work of all different workers in the precious metals, jewellers, gold and silversmiths, repousée-workers, sculptors in bronze, and inlayers of metals. One difficulty from which other skilled industries are free would here be encountered, namely the high price of the raw material employed. Careful regulations would probably obviate the worst difficulties of the case; and the drawbacks would be much more than balanced by the advantages offered by such a school. If we remember rightly a somewhat similar proposal was placed before the Goldsmiths' Company only a few years ago: nothing of the kind has however yet been actually attempted in this country.

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Before passing away from the subject of conjoint schools and workshops some mention should be made of another school of very different organization. The *Institution de Saint Nicolas*, in the Rue Vaugirard, Paris, is an apprenticeship school of unique type. Founded in 1827 by Monsignor de Bervanger, it is under the entire control of a religious guild known as the Frères des Ecoles Chrétiennes, who devote themselves wholly to education. In this establishment there are 980 boarders, of whom 220 are apprentices learning a trade in the school, or rather in workshops in the centre of the school precincts, let out to little "patrons" who are usually the proprietors of some small business in the city outside. No pupils are admitted who cannot already read and write. After a month's trial the parents or guardians of the lad sign a formal contract of apprenticeship with the "patron" or proprietor of one of the workshops. The apprentices work nine hours a day in the shops, and have in addition from two to three hours' elementary schooling under the tuition of the *frères*. There are sixteen of these workshops in active operation at the present time, the trades thus taught being as follows:

1. Marble Masons.
2. Bookbinders.
3. Optical Turners.
4. Compositors.
5. Printers.
6. Working-Clockmakers.
7. Makers of Bronze Mountings for Clocks.
8. Makers of Bronzes ("*ciseleurs*").
9. Makers of Wind Instruments.
10. Gilders.
11. Carpenters.
12. Portmanteau-makers.
13. Wood Carvers.
14. Wood Engravers.
15. Makers of Philosophical Instruments.
16. Map-engravers (on stone).

For the last four of these occupations the duration of apprenticeship is four years: for the rest three years. The parents must pay for the board and lodging of the boy a sum of £16 16s. annually, except for boys who have entered under 12 years of age, for whom their parents pay £14 8s. per annum. The manual instruction is gratis, but the work of the apprentices

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is entirely at the disposal of their 'patron.' They are not paid beyond an occasional 'gratification' for good work. If they stay four years the patron himself pays to the establishment during the fourth year the fees for board and lodging. The patron of each separate *atélier* provides all tools and materials. He is responsible for the apprentices being really taught; he devises their work; he either goes himself, or sends his foreman for the day, to superintend operations. The whole establishment is conducted under the strictest surveillance on the part of the *frères*. To all appearance the masters and foremen take pride in the progress of their pupils; though they themselves are often in a very small way of business. Naturally they endeavour to make the work pay; and here is obviously a weak point in the system: there is no provision for that very useful class of exercises which though commercially unremunerative are of the highest value as a means of training the beginner. Some of the work executed in these workshops is excellent. The Map-engraving is particularly good, has won medals at Paris, Vienna, and Philadelphia, and is patronised by the Minister of Public Education. The wood engravings, many of them also drawn on the wood by the apprentices themselves, are excellent, and would not discredit the 'Graphic' or the 'Illustrated News.' On the other hand the products of some of the shops are poor and run too much in old grooves. The wood-carving was good, but the carpentry disappointing. There appeared to the writer to be much room for improvement in the methods of teaching. There was little of scientific system or precision. In no single instance did working-drawings appear to be used, and on enquiry it was ascertained that the teaching of drawing and modelling, though based upon an excellent system devised by one of the brotherhood, was restricted to "those who had need of it in their occupation." The dormitories and refectory of the house are admirable. The results appear to be fairly satisfactory. The pupils on leaving find employment at once, and though they have learned but one

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business, and that in a cramped and narrow manner, are steady and plodding so that in time many of them become masters or foremen in *little* businesses. As to the financial position of this establishment it is satisfactory. When it was visited in 1867 by Mr. Samuelson* there were only 700 boys of whom 140 were apprentices, and the income of the school from school fees and subscriptions was about £25,000. The income for the last year was above £46,000, (1,168,809 francs), of which only £953 was derived from subscriptions and legacies. The institution is therefore virtually self-supporting, thanks to the self denial of the fifty worthy *frères* whose services are given for a nominal salary. It is regretable that in this institution there is so little done to bring the education of the school room to bear directly on the work of the shops. The opportunity of technical training thus lost would if turned to account probably remedy the points at present open to criticism. Twenty years ago this school took the lead in apprenticeship education, but now it is left far behind. It is organized on the double basis of an educational and a "religious" institution, which complicates the question with considerations outside the scope of the present essay.

There are a few smaller schools of kindred organization in France, among which the following may be named:

Orphelinat de Nôtre-Dame Preservatrice, Impasse des Vignes, Paris. A school for about 95 children, mostly young, with workshops and boarding-houses for apprentices going out to work.

Orphelinat et Ecoles Professionelles de la Providence-Sainte-Marie. Rue de Reuilly, Paris. A Technical school for about 60 boys and 120 girls. Teaching of vellum-painting, making artificial flowers, dress-making, fan-making.

Oeuvre des Apprentis Orphelins. Rue Lafontaine, Auteuil, (Paris). A kind of industrial school for over 200 orphans and waifs. Trades taught are printer, plaster-ornament maker, shoemaker, carpenter, locksmith, and gardener.

* Letter of B. Samuelson, Esq., M.P, to the Vice-President of the Committee of Council on Education, concerning Technical Education in various Countries abroad. (1867.) p. 13.

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HALF TIME SCHOOLS.

The only solution of the problem of apprenticeship education which remains to be considered is the system of *Half-time Schools*. This system, English in its origin, though almost discarded in this country* since the time when the passing of the Factory Act of 1856 put an end to the relay system, has been revived in France in consequence of the law of 1874 to which allusion was made on page 15. Thus, in April 1878, a Half-time school was opened at Puteaux, to accommodate the children under fourteen employed in two large dyeing and cretonne-printing factories in that suburb. Three Half-time schools have also been organized in Paris; two in the III^rd^ and one in the XIX^th^ *arrondissement*. These schools are intended for apprentices from ten to twelve years old, and are reserved for boys in the morning, girls in the afternoon, or *vice versa*. M. Gréard, to whom the initiative of these schools is due, remarks that there are 34,000 minors employed in Paris, of whom half have not yet completed their primary education. No attempt has yet been made to utilize the Half-time Schools for the purposes of technical teaching.

GENERAL CONSIDERATIONS.

Having now discussed in detail the various types of Apprenticeship School, we are in a position to review in their wider bearing some features common to all the divers forms assumed by the New Apprenticeship. As was laid down at the outset, the *raison d'être* of these Apprenticeship Schools is the decay of the old apprenticeship system.† Without apprenticeship in

* I am indebted to Dr. J. H. Gladstone for the information that there are two half-time schools in operation under the London School Board, one at Bethnal Green, the other at Southwark.

† "Accustomed only to our English Factory system in its maturity, it was long before I could understand how, and why, the plan of teaching trades in a school was first conceived. It appears to have arisen from two causes; the first was *the insufficiency, the insincerity of the ordinary apprenticeship to handicrafts*." (Letter of B. Samuelson, M.P., 1867. p. 35.)

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some form or other it is impossible for a young workman to become acquainted with all the details of his craft in all its departments. Without apprenticeship he may become a specialist, acquiring the knack of doing one single thing, and continuing to do it mechanically all his days: but that is not learning a trade. We cannot call him a cabinet-maker who has only learned how to shape chair-legs for one kind of chair. Now, advantageous as extreme division of labour may be from the point of view of the capitalist employer who may have resolved to view the human beings under him as simply machines for producing wealth, there is no question that extreme division of labour tends, at least in most industries, to lower the standard of workmanship*. It also facilitates industrial crises, firstly by destroying the workman's pride in his work, and secondly by rendering him incapable of turning to another occupation in time of need. Since the old apprenticeship once possible has virtually lapsed, there is nothing to save the young artizan of the rising generation from degenerating into a mere machine, unless a new agency can be practically organised to prevent him from drifting into this narrow range of capabilities so undesirable for his own sake. Such an agency is the Apprenticeship School. Apprenticeship Schools are not wanted to make specialists. Specialists trained only in a specialist school would be the narrowest of the narrow in their capabilities. What is claimed for the Apprenticeship School, not as a hypothetical benefit, but as the real result obtained in the cases adduced, is not that its pupils possess just a bare minimum of knowledge sufficient to procure them means of subsistence in one narrow depart-

* To give but one instance, drawn from the watch-making industry; the celebrated M. Bréguet in his Report on the Products of the Watchmaking Industry at the Paris Exhibition of 1867 states that the best *rough* watch works come from the valley of the Lac de Joux, "the only place where watches are constructed by one and the same hand, framework and wheels, hands and dial." That is to say the individual pieces of the mechanism are better made by workmen who know how to do everything than by specialists working under division of labour such as exists to so unparalleled an extent in this industry.

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ment of one restricted industry, but that they possess both manual dexterity and a fair technical knowledge which will enable them not only to earn more and to turn out better work, but also to be less at the mercy of the fluctuations of trade for their means of subsistence. If a specialist falls upon bad times he may starve: it is his misfortune, but it may not be his fault. But it is the *fault* of the skilled workman of wider capabilities—at least in nine cases out of ten—if he cannot find work that will procure him his living. It is claimed, then, for apprenticeship schools that they benefit the workman by fitting him to work better, at higher wages, and in greater security than he otherwise would do. From the point of view of the workman, therefore, Apprenticeship Schools are better than no apprenticeship at all. The few Trades' Unions existing in Paris, usually known as *Corporations ouvrières*, appear to be convinced of this; for though they at first conceived objections to the system of Apprenticeship Schools, they have come round to a favourable view of them; and some of them have even proposed to set up schools of their own to benefit their own industries. The *Ecole de dessin et modelage* established in the Quartier du Temple by the *Chambre syndicale ouvrière des bijoutiers* is an attempt in this direction.

It remains to be demonstrated that, from the point of view of the apprentice, the New Apprenticeship is better than the old apprenticeship amid modern social conditions can be. We have seen that so far as it gives a wider range of information and a real instruction in technical principles it is better. But it is better also for practical work, in so far as it shortens the needlessly long years of apprenticeship, and imparts at an earlier age all the manual capacity that apprenticeship in any form can impart. The statistical results of the best Apprenticeship schools,—of which those of the Boulevard de la Villette and of Besançon may be taken as typical,—distinctly prove this. A little consideration will show why this should be the case. It may be taken as an axiom that speed and precision in doing a

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thing are only acquired by doing that thing a number of times, slowly and carefully at first, rapidly and well afterwards. It must equally be conceded that where the art of doing a considerable number of things well and speedily must be acquired, it will be a gain of time not to do any one thing more often than is necessary to acquire the desired speed and precision. It will also be a gain of time if the various things which have to be learned are learned in their proper order, which is that order in which the doing of one thing shall best prepare the way for doing the next thing. If these points be granted the whole *raison d'être* of Apprenticeship Schools has been conceded. In an Apprenticeship School, in the first place, the various manual exercises are presented to the young *débutant* in the order best suited and most helpful to his growing capabilities,—a course impossible to the apprentice in the ordinary shop where the odd jobs that are not too hard are promiscuously set him as tasks. In an Apprenticeship School, in the second place, he is kept on doing one thing until he does it well and with fair speed, *but no longer*; he passes on to the next exercise to master its difficulties, and then on to the next. How different from the poor drudge of the shops who must be doing something that will directly *pay*, whether good for him or not! Further, time can be saved in an Apprenticeship School by the rough work of the novice serving as the half-prepared material of the more advanced pupil, who is thus saved the labour of doing over again that which he already knows how to do rapidly and well. In a workshop where there are but one or two apprentices this is a matter of no great moment: but in the Apprenticeship School, where there are scores or hundreds of pupils in all stages of proficiency, this method of saving the time of the advanced pupils may be, and is, systematised to a high degree. Again, it is admitted that a theoretical knowledge helps the workman in the execution of his work, by saving him from trying bad methods; in the Apprenticeship School no work is begun until the method and rationale of that which has to be done has been

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explained. But how seldom can this be done amid the hurry of the manufactory! Lastly, the Apprenticeship School may in certain ways give a more perfect skill to a workman than the workshop gives, by using special means not available for the apprentice in the workshop. An example, again drawn from the watchmaking industry, will explain this somewhat general remark. It is well known to watchmakers that those apprentices who have learned filing and metal-turning in an engineering workshop, or in an instrument manufactory, use the file and the lathe in watchmakers' work better than the apprentices who have learned the use of these tools on the small scale of watchmakers' work only. In the Apprenticeship School of Besançon every pupil is taught filing and metal-turning on the large scale first. It would be manifestly absurd to expect every watchmaker who takes apprentices to set up the appliances for this larger work. This is but one illustration of many that might be adduced from the various handicrafts, of the advantages offered by the New Apprenticeship over the old. It need hardly be added that inasmuch as the pupil of the Apprenticeship School is not required to dust out his master's premises every morning, nor to wash the floors, nor to run errands hither and thither, he is able to concentrate on acquiring his trade moments which are irrevocably wasted for *some* apprentices.

If there still remain any who adhere to the notion that after all apprenticeship of the orthodox traditional type is necessary for learning a trade, let them take consolation in the reflection that as the years spent in the Apprenticeship School are but few, there will still remain time enough for the pupil who has finished his course in the school to be "bound" in due form; and there is nothing to hinder the pupil from passing through a regular apprenticeship—except that he already knows more than that apprenticeship has to teach.

Let it be remarked in passing that a great many of these considerations which we have advanced in respect of apprenticeship apply, *ceteris paribus*, to the case of apprentice-girls with

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quite as much force as to the case of apprentice-boys. We have however purposely abstained from entering here upon the question of female apprenticeship; and though a few Apprenticeship Schools for girls are incidentally mentioned in this memoir, it must not be understood that there are no others in France. On the contrary there are many, which only lack of space and our desire not to complicate the main question under discussion, deter us from enlarging upon.

The careful reader of the detailed accounts now given of the Apprenticeship Schools will have observed that no single school has been held up as perfect, either in organization or in operation. Earnest advocacy of a principle may consistently be accompanied by a critical discernment of the weak points in its practical applications. There are many objections which may be raised against such schools as we are advocating; objections founded either on abstract principle, or on the facts of experience. We are fortunate in being able to deal with many objections of the former class by the light of experience. But with regard to the objections founded on the practical working of the new apprenticeship, it would be highly undesirable to attempt to hold a position of blind partizanship, or to deny that some of them possess considerable force.

It is, for example, unquestionably a weak point in such schools as those of Besançon, of La Villette, and of the Institution Saint Nicolas, that the apprentice is brought up, so to speak, in a hot-house. There are some advantages in rubbing shoulders with men of the world earlier, in larger workshops, and in the very rush of trade. There is unquestionably the risk that the young apprentice should not realise the value of time, and of money, and of all those little ways of meeting the demands of customers, that are so important in practical business life. The "hot-house" objection applies more or less to school life of every order. Does it apply the more strongly to schools where there is only a literary education, or to schools where half the studies are addressed to practical ends? Does not the know-

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ledge on the part of the teachers that these are weak points in their school system awake in them the ambition to turn them into strong points? As a matter of experience, a very few days' sojourn in the larger workshop suffice to correct the views of the apprentice who has worked through his school course and gone out. He is not yet too old to learn.

Another weak point disclosed by the experience of these schools—or some of them—is that a certain proportion of the apprentices when they enter a workshop, where they find themselves so much better instructed than the workmen with whom they mingle, are apt to become conceited and to give themselves airs towards men who are older and of more experience, though not so well informed. But again experience suggests the remedy. Occasional visits paid by the school-apprentices during the summer months to the workshops of large manufactories in their neighbourhood have been found extremely beneficial in this regard.

Closely bound up with the last difficulty is the jealousy occasionally exhibited by other workmen towards the apprentices from the schools, whom they regard at first as *prigs*. The feeling is not unnatural, but has not been found so serious as to produce any organised hostility, and generally subsides in a few days or weeks. The masters, too, are sometimes jealous of the better-instructed apprentices, but they generally soon begin to realise that they have got hold of a valuable and intelligent instrument with whom they are well contented; and they generally end by sending an application to the school when they want another young hand.

There is another weak point in the operations of these schools, which appears to be inherent in all apprenticeships where there is no legal contract: namely that parents under the pressure of expense, and the desire to make the earliest profitable use of their children, remove them from the schools before they have come to the end of their time. Thus about one half only of the apprentices who enter the school of La

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Villette stay the whole three years: and often they are the best and most promising pupils that are thus prematurely withdrawn. Whether a form of legal contract would remedy this may be doubted. The certificate of proficiency is granted only to those who complete their course, and many undoubtedly are induced to stay till the end who otherwise would have been withdrawn. At the Havre school, where there is a Committee of Patronage who endeavour to seek out places for the pupils as soon as they leave, there is a powerful influence at work to retain the scholars till the end of their course. A still more effective means has however been found in the fortnightly or monthly 'gratifications' paid to the apprentices. Though not high, these small sums—not reaching a shilling a week on the average—suffice to make the apprentice regard himself as in receipt of wages; and appease the desire of his family that he should be earning something. They even enable him also to lay by a little portion in the savings' bank, and so encourage the habit of thrift.

An objection which rises to the lips of many practical men when they first hear of these schools, is that there are some trades which cannot be taught thus. The objections of practical men always deserve a respectful hearing, and must be met by practical results. The principle has not yet been applied for all trades. Where it has been tried it has succeeded. It will be time enough to make the declaration when in any particular trade the principle has failed in application. If any trade can be discovered in which there is nothing to be learnt, in that trade clearly there would be nothing to teach. But in every trade that which has to be taught ought to be taught well and systematically by intelligent and trained workers, not haphazard under ignorant or often debased men who possess no idea of teaching, and who often do not know the proper names of the tools or materials they handle but give them slang names, meaningless and even sometimes gross. So far as the experience of those who have had to do with the working of these schools has

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led them to form a judgment, they agree without exception in the opinion that there is no trade for which apprenticeship of the new type may not be advantageously substituted for the old. A few years ago we should have derided the idea of a course of lessons in carpentry or in carriage-building. But lessons in carpentry are given with emphatic success, and an examination in carriage-building is included amongst the subjects of the Technological Examinations* organized by the Society of Arts in London. Why should not technical training in such crafts as cutlery, saddlery, and tin-plate work be similarly systematised for the benefit of the next generation ?

But here the objection is interposed that it will be impossible to have an Apprenticeship School for every trade: that trades are too numerous and too scattered. Once more let us remark that Apprenticeship Schools are not wanted to make specialists. The elements of many different trades can be taught together, for the principles of the tools, the machinery, and the processes are common to many. Thus grouped, there will be little difficulty in finding a place for every trade side by side with its congeners. The locksmith and the farrier may begin side by side with the bell-hanger, the fitter and the instrument maker. The experience of the La Villette school shows how advantageously the workers in wood and in metals may learn together the matters common to the great group of industries that are comprised in these general terms.

A much more serious objection is the difficulty of obtaining the right teachers for such schools. Happily there have existed in France for many years several technical schools of the first order, the *Ecole Centrale des Arts et Manufactures* of Paris, the *Ecole Lamartinière* of Lyons and the three famous *Ecoles des Arts et Métiers* † of Châlons, Aix, and Angers. These are not

* These examinations are now transferred to the City and Guilds Institute of Technical Education.

† British readers must be careful not to confound these *Ecoles des Arts et Métiers*, which are strictly Technical Colleges, with the *Conservatoire des Arts*

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schools for the children of artizans; they are frequented by those who become foremen and masters and who wish to obtain the highest theoretical and practical training, and have the capacity for it. We have seen (page 52, foot note) how in 1867 it dawned upon Mr. Samuelson, M.P., that the plan of teaching trades in a school had a double cause. One of these was the decay of apprenticeship, the other was the gradual introduction of machinery to do work hitherto done by hand, and which necessitated foremen skilled and trained as none had previously been. The great schools we have referred to made this training possible to the middle and upper classes of the industrial population, but did nothing directly for the far greater class of artizans. But the pupils of these schools are to be found in every part of France, and the influence of their teaching has steadily been working its way, so that competent practical teachers can be had for at least those industries which are allied to engineering and agriculture. Thus for example, the *chef des travaux* in the workshops of the school of La Villette, M. Bocquet, is a pupil of one of the *Ecoles des Arts et Métiers*. The workmen who act as foremen of the workshops under him are simply skilled artizans engaged by the week or month, but the spirit of the teaching is caught from the *chef* who organizes the methods of the exercises and directs their execution. The lower technical training of the artizan pupil only becomes possible when the higher technical training of the teacher has been effected.

Lastly there is the objection on the score of cost. The statistics already given show to a fair degree of approximation what that cost is in the principal cases. To train an apprentice at La Villette costs on the average £21 3s. 5d. a year, though the sum varies considerably between the apprentice metal-turner and the apprentice carpenter. At Besançon the annual cost of the education is £17 4s. 9d. In the school of the Rue Tourne-

et Métiers of Paris, which is a splendid Museum of the technical industries, and contains a very large and beautiful collection of engineering models.

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fort, which must be regarded only as preparatory to apprenticeship, the cost is £7 19s. 3½d. Under the singular system of the Institution Saint Nicolas, neither the apprentice nor the school is at any charge for the trade teaching: but the teaching here is the least satisfactory in type of any; there is no true technical education, and the old apprenticeship still exists, only under restricted conditions. It is a school of apprentices but not of apprenticeship. As to the cost of teaching in the schools founded by MM. Chaix, Lemaire, Soufflot, Hayem, etc., it is impossible in the absence of exact information to form any average estimate of cost. The opinion of the heads of these houses is quite unanimous that the outlay has been many times returned to them in the greater efficiency of their workmen. In other words such schools *pay*, and pay well. In France, where for so many years the theory of education at the expense of the Government, or of the Municipality, has been consistently maintained and acted upon, the progress of these schools is watched with great interest; and their number is continually increasing. Apprenticeship schools of one or other type are being founded in Bordeaux, Caen, Autun, Lille, and Rouen. A school of the Rue Tournefort type is asked for by the X^th^ *Arrondissement* of Paris: and a project for organizing others has recently been introduced by M. Nadaud before the Chamber of Deputies. Clearly the question of cost is not going to stand in the way in France. The New Apprenticeship has taken deep root and exhibits every sign of lasting vitality.

In thus discussing the Apprenticeship schools of France little allusion has been made to technical training in other countries. The omission has been intentional, for although technical schools abound in Germany, Austria, Belgium, and Switzerland, and are in many respects more thoroughly developed than in France, our selection of the French and chiefly of the Parisian schools has rendered a much more compact treatment of the subject possible, has spared us from many digressions upon higher aspects of Technical Education, and has enabled us to

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deal with schools that lie for the most part so near together as to be very accessible to any person who may be spending a holiday in France.

Germany is indeed far ahead of France in the development of the higher technical training: her *Real-schulen*, *Gewerbeschulen*, and Polytechnic Schools of all kinds testify to the universal sense of the need of Technical Education. We see a result of this in the numbers of German skilled workmen who come to England; many of them taking places as foremen in our workshops. The fact that we get no Frenchmen to take similar positions must not be viewed as reflecting on the quality of the higher technical training of such schools as the *Arts et Métiers* of France, but rather as a result of the difference of national habits; the Germans adapting themselves much more readily than the French to the manner of living and speech of our country. The fact remains that the schools we need in England are those of the types we have been describing as existing in France, rather than the *Real-schulen* or *Gewerbeschulen* of Germany. Nevertheless it is not self-evident that a principle which suits the condition of things in France must necessarily meet with a like degree of success on this side the Channel. There is diversity enough in the different types to choose from, and the probability is that no one type will satisfy every British industry. Our business is not to copy, but to organize and develop for ourselves, in accordance with the conditions that obtain in each industrial centre. We have one element to reckon with, amongst the social and economic factors of the problem, which in England is far more influential than in France. The Trades' Unions of France, which are in France comparatively unimportant bodies, have on the whole favoured the establishment of such schools; some Unions having, as we have seen, started schools for themselves. The Trades' Unions of Great Britain, though of far greater importance in our industries, differ considerably from each other in the degree of their development; they are not all equally powerful, equally wise,

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equally organised; and some of them possess already rules affecting the old apprenticeship* which they must entirely remodel if the New Apprenticeship is to grow and flourish. The creation of Apprenticeship Schools is a work in which they can aid most powerfully; and there will be found no surer means of elevating socially, intellectually, and morally, the skilled artizans of the country. The principle of union and the principle of division of labour applied to the problem of apprenticeship result logically in the Apprenticeship School. Let us not reject the principle because it happens to have been first worked out to practical issues on the other side of the Channel.

The patriotic objection which some persons advance, that the Continental system is bad because it is Continental, and that the British system can be the only right one, is ignorant in the extreme; and is a piece of that foolish wilful blindness to the methods and the progress of foreign countries which has helped to aggravate the present industrial depression. There is no "*British system*" of apprenticeship, only a British *chaos* from which all system vanished long ago. There is no one Continental "system"—there are hundreds of different systems, of which we have selected a few examples,—one common principle underlying them all; namely, that when anything has to be taught it should be taught as well as possible, systematically, by competent persons, instead of being taught badly, unsystematically, by ignorant and even vicious persons. Let those, moreover, who boast in the long supremacy of British manufactures over those of France and Germany as a proof of the superiority of the system under which they were produced, remember that the growth of these technical schools in France and Germany has been a consequence, not a cause, of that long supremacy;—for only by training their workmen could those nations hope to compete with the vast material advantages of our mineral supplies;—and

* Vide Mr. Howell's article on *Trades' Unions, Apprentices, and Technical Education* in the Contemporary Review; October, 1877.

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that the rapid strides made in the quality of the products of France, Belgium, and Germany, now such an ugly feature in our industrial horizon, are largely due to the institution of schools upon this principle.

There are not wanting other signs on the horizon, of significance in this problem of the relation of science to labour. The demand for technical education is growing louder year by year. The scholastic education given by our School Boards—the only one which a paternal Education Department permits them to offer to the children of our artizan classes—is viewed with increasing impatience. For the first time since the introduction of machinery there are evidences that in certain industries modern machinery will favour the development of domestic labour, of labour in the family, which hitherto the use of machinery has tended to destroy. But whether this tendency, so desirable from a social and moral point of view, can take rapid effect is almost entirely a question of the technical education of the artizan. It is not that we have not really skilled workmen amongst us. We have them, and no foreign skilled workmen are their equals. But they are only units in a crowd: it is the intelligence of the average which gives the stamp, and *that* it is which must be raised. We are growing impatient of the increasing incursions of foreign trade within our borders. We have seen our silk-ribbon trade vanish; our home-manufactured tools are being displaced by imported tools; we are deluged with watches from foreign markets. And we talk of inequality of duties, quite forgetful of the fact that if the products of our *skilled* industries at home were only superior to those of foreign markets, no one would want to buy foreign rubbish, nor would it pay any one to import it. If free-trade is ultimately to prevail all the world over; then only by possessing superior workmen can the less-advantageously situated countries compete with the industries of those which have abundant mineral wealth and other natural advantages. If, on the other hand,—as seems at present more likely—free-trade is not to be definitely established between the

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nations, then, clearly, that nation which has natural advantages can only hope to avail itself of those advantages if its workmen are at least no worse educated than those of other countries. Take which view we will, technical education, and above all the technical education of the artizan classes, is a *sine qua non* of the future industrial prosperity of Great Britain.

What steps then must be taken to give effect to the New Apprenticeship? What are the essentials of success for an Apprenticeship School beyond the mere understood necessaries of good buildings, a fair start, competent and energetic directors, and an adequate supply of the sinews of enterprise? The more closely the question is examined into, the more evident is it that, other circumstances being equally favourable, two things will determine the success or failure of the school: firstly, the obtaining of the right kind of teachers; secondly, the adoption of a system of instruction based not on written words, which are the language of literaryism, nor on mathematical symbols, which are the language of the abstract sciences, but upon *drawing** which is the language of the manufactures, the handicrafts, the constructive industries of all kinds.

How then can these two elements of success be provided for? "In the absence of the higher technical training the dilemma occurs between the abstract learning of the teacher trained only in the University, and the practical knowledge of the superior artizan, whose only culture is that of the workshop." We have no *Ecoles des Arts et Métiers*, no *Ecole Centrale*, no *Polytechnic* Universities like those of Stuttgardt or Zürich, wherein to train

* Of Drawing *as an Art* nothing is said here. I have avoided aesthetics purposely, desiring to treat the points under discussion purely upon the basis of the *facts* before us. I am by no means insensible to the great and real benefits which a training in Art would bring to British Artizans. The perception of the *true*, which I advocate as the essence of good technical training, and which is only to be acquired by faithfully following out methods of precision, would only benefit, and be benefitted by, a perception of the *beautiful* such as an artistic training can inculcate. The connexion is indeed closer than most persons suspect or admit. The matter cannot however be discussed at length in this place.

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the indispensable teachers. The system pursued by the South Kensington authorities for the Science teaching under the Science and Art Department, endeavouring to spread the teaching of abstract science by the agency of teachers whose scientific knowledge is a bare minimum, would involve hopeless failure if applied to the technical teaching of the Apprenticeship Schools. Next after a capacity for teaching, the most necessary qualification in the teacher is that he should be both a workman and a student, and possessed of that rare faculty so well described in the programme of the Besançon School as the power of making a continual comparison between theory and results at which practice has arrived. Such men there are, in spite of our lack of higher technical schools, but they are few; and to them commerce often opens a more lucrative, though perhaps less congenial prospect.

The right men once obtained as teachers, they will not be long in developing a system of instruction, practical and theoretical, adapted to the end in view. The teaching of Industrial Drawing,* which we have defined as the science and art of making and "reading" working-drawings, exists as yet only in a fragmentary state. It will be the business of technical teachers during the next ten years to elaborate and consolidate this body of teaching into an organic whole. That which is wanted is not a treatise of principles nor yet a series of examples as "drawing-copies": for the principles are well ascertained and clearly defined, and of drawing-copies there are far too many already.†

* Vide page 39.

† I have only to-day (July 28th) seen in a northern "Fine Art and Industrial Exhibition" a series of exhibits by a local School of Art, in which appeared one excellent machine-drawing: a very careful copy of a French lithograph. Lines and colouring were alike perfect: but the whole as dead as the wall against which it hung. The student who produced that work had learned nothing of the practical construction of the machine by the hours spent over his drawing. It was a copy of a copy. Not a speaking volume of instructions how to construct the machine, which is the real function of a working-drawing. Yet it was fairly typical of the kind of studies offered in English Schools of Art to pupils who want to learn Mechanical Drawing.

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What is still wanting is a method of teaching, a practical exposition of the art and science of constructing working-drawings and of translating them at need into wood, or iron, or gold. With these elements permeating the system, we may anticipate for the New Apprenticeship a future potent of good.

It is evident, then, that a first step of the highest importance will be the foundation of a system for training competent teachers. Local Technical Schools and Colleges must be established in the heart of every industrial district, to train the future foremen, masters, and technical teachers in the scientific principles underlying the practical work of the factories and shops of the local industry. To these no one should be admitted who has not already done substantial work in a recognized workshop, and who has not already shown some knowledge of pure science in one or other department. The pestilent notion that a person can instruct who is himself not half instructed must be once and for ever discarded. The future technical teacher must go through the same training as the future master workman, or his teaching will avail little. One reason why we have so few Technological Classes, under the scheme already adverted to as having been founded by the Society of Arts, is that teachers of the right calibre are hardly to be had. That difficulty is not removed by the amelioration recently effected in the status of those classes, which since their transfer to the Institute for Technical Education of the City and Guilds of London, are much more advantageously situated as to payments on results to successful teachers. No system of payments on results however liberal or judicious will however effect the training of teachers for their work, excepting in so far as it induces men already better trained to take up the work of teaching. That which is urgently needed is a greater supply of such men not only as teachers, but as workmen and as foremen and masters. It is for this end that Local Technical Schools and Colleges, such as those recently organized in

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Glasgow, Leeds, and Bradford, must be established in every district where a skilled industry exists.

To give method and system to such schools, as well as to furnish them in turn with teachers of wider information, another step must be taken. There must be a Central Technical College, preferably situated in the Metropolis, affording facilities for the highest Technical Education to those who shew themselves competent to receive it. In such an institution alone can future technical teachers in all departments of industry acquire that common knowledge of applied science, and of educational methods in general, that it is so desirable to spread through all the ramifications of local technical institutions. Through such an institution alone can community of thought and method be obtained. By such an institution alone can the work of technical education be pioneered and organized in outlying industrial districts where the level of intelligence may be low or the existing educational machinery bad and insufficient. Such an institution must aspire to be for England, what the *Ecole des Arts et Métiers* is in its place to France, and the *Polytechnicum* is to Zürich and to Stuttgardt, a real Technical University.

The creation of such a system will necessarily be the work of time. Bit by bit the fabric must be reared; and the non-existence as yet of a Central Metropolitan College ought not to prevent the progress of the work of founding Local Colleges and Local Schools.

Should however the pressure of disadvantageous circumstances delay for a few years the foundation of these much needed nurseries for the future craftsmen of our country, there is much left that private enterprise may accomplish. Technical Classes may do something, though their value cannot be fully realized except where really trained and cultivated workmen can be found as teachers. There are in this country many schools, especially private schools, to which, at a trifling cost, a workshop at least for carpentry might be attached. There are many opportunities, especially in such schools, of introducing

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in the form of lectures the teaching of science, both pure and applied: and there is ample scope for developing the teaching of drawing and of modelling in clay. The experience of France in the remarkable results which have followed the law of 1874, relative to the schools established in manufactories, affords a most pregnant suggestion to the heads of great industrial establishments and employers of skilled labour as to the simple and inexpensive means by which the character of the labour of their apprentices may be raised above its present level. And even where no regular school can be established in the factory much may be done by establishing drawing-classes for the young employés.* It would be a truly profitable speculation in many factories in England where skilled labour is employed.

CONCLUDING RECOMMENDATIONS.

The considerations which have now been urged at some length traverse the entire question of the New Apprenticeship in its relations to the existing educational systems. But that the needful reforms which are the logical issue of those considerations may be more clearly understood, they are embodied in the following definite recommendations.

Firstly. Modify the teaching of your elementary schools for the children of artizans, so that it may be more appropriate to the needs of their particular walk in life, and may more directly tend to develop the faculties by which they will hereafter earn their living.

Secondly. Bring the School Boards more directly into relation with the municipal governing bodies, and give them jointly a wider discretion over the curriculum of education in the schools.

* An excellent example of this procedure occurs in the workshops of M. Brissonneau of Nantes. His apprentices, separated from the workmen, work eight hours a day in the engineering shops under a competent foreman, and three hours in a room set apart for drawing. This system dates back beyond 1874.

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Thirdly. Reorganize the Education Department, and place it under a Minister of Education.

Fourthly. Insist on Drawing being taught to every artizan child in your schools: it is as essential to his work as the traditional three R's: always remembering that *Drawing*, for the artizan child does not mean the perpetration of simpering nymphs, nor of staring dogs' heads, nor of hideous lengths of landscape, nor yet of copied dead Greek ornament; but that it means that which we have defined as 'Industrial Drawing,' the art and science of making and "reading" working-drawings; that is, drawings made to scale so representing objects of wood, or iron, or other material, that they convey to the workman all the necessary instructions for constructing the object drawn.

Fifthly. Reorganize the system of Science Teaching of the Science and Art Department, in order that the reproach may be removed that a certificated "Science Teacher" is a person possessed of *minimum* knowledge and minimum capacity for teaching science.

Sixthly. Organize Intermediate Schools to carry on the work of general education from the point where the elementary schools stop short.

Seventhly. Create Apprenticeship Schools of one or other of the types now explained, in order to provide for the children of skilled artizans a New Apprenticeship in lieu of the decayed system of traditional apprenticeship which neither does nor can afford them a satisfactory or sincere training in the handicraft trades.

Eighthly. Organize Technical Schools in the heart of every industrial district, to train foremen and masters in the scientific principles underlying the practical work of their factories and workshops.

Ninthly. Organize Technical Colleges to complete the work of the Technical Schools and to train technical teachers.

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Tenthly. Found a Central Technical College in the Metropolis to concentrate and pioneer the work of the Technical Colleges and Schools; and essay to develope it in time into nothing short of a great Technical University.

This is what we might do—what we may yet do. But if this is to be done, the nation must move towards its accomplishment with a spirit very different from that with which it has been content to view the question of technical education during the past quarter of a century. We began this memoir with a reference to a letter addressed in 1867 by Dr. (now the Rt. Hon.) Lyon Playfair to the Schools Inquiry Commission, commenting on the state of technical education at home and abroad. Dr. Playfair had previously, in 1853, distinctly laid down his opinion* that as *an inevitable result* of the attention given to Technical Education abroad, and its neglect in England, "other nations must advance in industry at a much greater rate than our own country." What have we done in England during the six and twenty years that have elapsed since those words were penned to remedy the state of things which even then suggested such a bitter forecast of coming evil? How does England stand better to-day, so far as the industrial education of her people is concerned? She has to-day her School Boards and her elementary schools; and that is something, though the system be terribly defective in some aspects. But what have we more? Well, we have organized a few dozen Mechanics' Institutes and a few score Schools of Art. We have also established a few hundred disjointed Science Classes in which half-instructed teachers discourse on abstract science to audiences that form a very insignificant minority of the hundreds of thousands who need instruction; there are moreover a few Technological Classes. And we have also, thanks to the benevolence of a few wealthy corporations and individuals, endowed one or two

* Dr. Lyon Playfair. *Industrial Education on the Continent.* 1853.

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schools for teaching Applied Science in its higher branches in a few select subjects.

But so the matter rests in England. International Exhibitions have come and gone, and have shown us from time to time the hollowness of our position. Report after Report, Commission after Commission, crisis after crisis, have passed alike unheeded; and capitalist manufacturers and unionist artizans either will not, or cannot, or dare not, confess that the core of all this rottenness is the failure of the old apprenticeship to cope with the requirements of the age and with the new social conditions which modern enterprise and the fierce rivalries of industry have brought about. If, however, capitalist manufacturers and unionist artizans desire to witness a revival of the skilled industries of Great Britain, and to renew the great commercial triumphs which Englishmen have won in past generations, the remedy rests in their own hands. They must show that they will, and can, and dare, give to the New Apprenticeship the power of a living reality.

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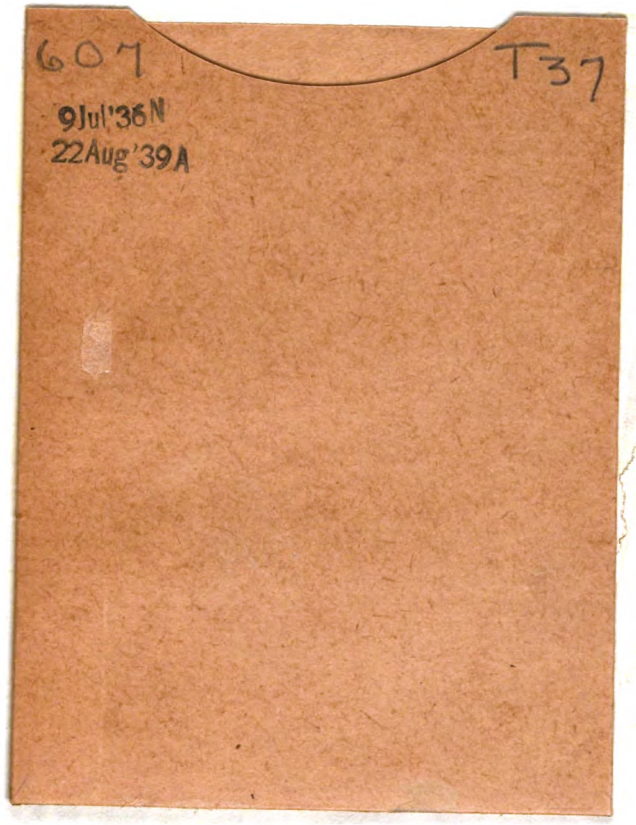

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